TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California
(Page 13 of 24)

Location	M07B-01	398-MW1	398-MW2	S21-DGS-VE01	S21-DGS-VE01	S21-DGS-VE02	OUTFALL G	S21-DGS-DP06
Sample Code	385-S21-023	385-S21-024	385-S21-025	385-S21-030	385-S21-030A	385-S21-033	385-S21-035	385-S21-046A
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	6/26/2001	6/26/2001	6/26/2001	8/7/2001	8/7/2001	8/7/2001	7/20/2001	8/9/2001
Sampling Depth (feet bgs)	-	-	-	8 - 9	8 - 9	8.5 - 9.2	0 -	15 -
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
1,1,1,2-TETRACHLOROETHANE				1 U		10 U		1 U
1,1,1-TRICHLOROETHANE	2 U	2 U	2 U	1 U	2 U	10 U	2	1 U
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 UJ	10 U	1 U	1 U
1,1,2-TRICHLOROETHANE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
1,1-DICHLOROETHANE	0.5 J	0.5 U	0.5 U	1 U	0.5 U	10 U	1	3.1
1,1-DICHLOROETHENE	2 U	2 U	2 U	1 U	2 U	10 U	0.4 J	1 U
1,1-DICHLOROPROPENE								
1,2,3-TRICHLOROBENZENE								
1,2,3-TRICHLOROPROPANE								
1,2,4-TRICHLOROBENZENE								
1,2,4-TRIMETHYLBENZENE								
1,2-DIBROMO-3-CHLOROPROPANE								
1,2-DICHLOROBENZENE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
1,2-DICHLOROETHANE	0.5 U	0.5 U	0.5 U	1 U	0.5 U	10 U	0.5 U	1 U
1,2-DICHLOROETHENE (TOTAL)	4	2 U	2 U		2 J		3	
1,2-DICHLOROPROPANE	2 U	2 U	2 U		2 U		2 U	
1,3,5-TRIMETHYLBENZENE								
1,3-DICHLOROBENZENE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
1,3-DICHLOROPROPANE								
1,4-DICHLOROBENZENE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
2,2-DICHLOROPROPANE								
2-BUTANONE	2 UJ	2 UJ	2 UJ		2 UJ		2 UJ	
2-CHLOROTOLUENE								
2-HEXANONE	2 UJ	2 UJ	2 UJ		2 UJ		2 UJ	
4-CHLOROTOLUENE								
4-METHYL-2-PENTANONE	2 UJ	2 UJ	2 UJ		2 UJ		2 UJ	
ACETONE	3 UJ	3 UJ	3 UJ		3 UJ		5 UJ	
BENZENE	0.5 U	0.5 U	0.5 U	1 U	0.5 U	10 U	0.5 U	1 U
BROMOBENZENE								
BROMOCHLOROMETHANE								
BROMODICHLOROMETHANE	2 U	2 U	2 U		2 U		2 U	
BROMOFORM	2 U	2 U	2 U		2 U		2 U	
BROMOMETHANE	2 U	2 U	2 U		2 U		2 U	
CARBON DISULFIDE	2 U	2 U	2 U		2 U		2 UJ	
CARBON TETRACHLORIDE	0.5 U	0.5 U	0.5 U		0.5 U		0.5 U	
CHLOROBENZENE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
CHLOROETHANE	2 U	2 U	2 U	1 U	2 U	10 U	0.9 J	1 U
CHLOROFORM	2 U	2 U	2 U		2 U		2 U	
CHLOROMETHANE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
CIS-1,2-DICHLOROETHENE				1.3		10 U		1 U
CIS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U		0.5 U		0.5 U	
DIBROMOCHLOROMETHANE	2 U	2 U	2 U		2 U		2 U	
DIBROMOMETHANE								
DICHLORODIFLUOROMETHANE								
DIISOPROPYL ETHER								
ETHYL TERT-BUTYL ETHER								
ETHYLBENZENE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1 U
ETHYLENE DIBROMIDE								
HEXACHLOROBUTADIENE								
ISOPROPYLBENZENE								
M,P-XYLENE				1 U		10 U		1.2
METHYLENE CHLORIDE	2 U	2 UJ	2 U	1 U	2 U	10 U	2 UJ	1 U
METHYL-T-BUTYL ETHER	5 U	5 U	5 U	1 U	5 U	10 U	5 U	1 U
NAPHTHALENE				1 U		10 U		1 U
N-BUTYLBENZENE								
N-PROPYLBENZENE								
O-XYLENE				1 U		10 U		1 U
P-ISOPROPYLTOLUENE								
SEC-BUTYLBENZENE								
STYRENE	2 U	2 U	2 U		2 U		2 U	
TERT-AMYL METHYL ETHER								
TERT-BUTANOL								
TERT-BUTYLBENZENE								
TETRACHLOROETHENE	2 U	0.3 J	2 U	1 U	2 U	10 U	2 U	1 U
TOLUENE	2 U	2 U	2 U	1 U	2 U	10 U	2 U	1.7
TRANS-1,2-DICHLOROETHENE				1 U		10 U		1 U
TRANS-1,3-DICHLOROPROPENE	0.5 U	0.5 U	0.5 U		0.5 U		0.5 U	
TRICHLOROETHENE	2 U	0.5 J	2 U	1 U	2 U	10 U	1 J	1 U
TRICHLOROFLUOROMETHANE								
TRICHLOROTRIFLUOROETHANE								
VINYL ACETATE								
VINYL CHLORIDE	0.4 J	0.5 U	0.5 U	0.9 J	2	10 U	0.3 J	0.6 J
XYLENE (TOTAL)	2 U	2 U	2 U		2 U		2 U	

Notes:
UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP06	S21-DGS-DP12	S21-DGS-DP12	S21-DGS-DP12	S21-DGS-DP13	S21-DGS-DP13	S21-DGS-DP14	S21-DGS-DP14
Sample Code	385-S21-047	385-S21-048	385-S21-049	385-S21-050	385-S21-051	385-S21-052	385-S21-053	385-S21-054
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/9/2001	8/9/2001	8/9/2001	8/9/2001	8/17/2001	8/17/2001	8/20/2001	8/20/2001
Sampling Depth (feet bgs)	20 -	9 -	15 -	25 -	9 - 11	16 - 18	9 - 11	17 - 19
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
1,1,1,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-TRICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHANE	1 U	1 U	1 U	2.8	1 U	1.4	1 U	1 U
1,1-DICHLOROETHENE	1 U	1 U	3.1	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROPROPENE								
1,2,3-TRICHLOROBENZENE								
1,2,3-TRICHLOROPROPANE								
1,2,4-TRICHLOROBENZENE								
1,2,4-TRIMETHYLBENZENE								
1,2-DIBROMO-3-CHLOROPROPANE								
1,2-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHENE (TOTAL)								
1,2-DICHLOROPROPANE								
1,3,5-TRIMETHYLBENZENE								
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-DICHLOROPROPANE								
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,2-DICHLOROPROPANE								
2-BUTANONE								
2-CHLOROTOLUENE								
2-HEXANONE								
4-CHLOROTOLUENE								
4-METHYL-2-PENTANONE								
ACETONE								
BENZENE	1 U	0.5 J	0.5 J	1 U	1 U	1 U	3.8	1 U
BROMOBENZENE								
BROMOCHLOROMETHANE								
BROMODICHLOROMETHANE								
BROMOFORM								
BROMOMETHANE								
CARBON DISULFIDE								
CARBON TETRACHLORIDE								
CHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CHLOROETHANE	1 U	1 U	1 U	1 U	6.7	1 U	1 U	1 U
CHLOROFORM								
CHLOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	1 U	1 U	540	1 U	1 U	1 U	1 U	2.4
CIS-1,3-DICHLOROPROPENE								
DIBROMOCHLOROMETHANE								
DIBROMOMETHANE								
DICHLORODIFLUOROMETHANE								
DIISOPROPYL ETHER								
ETHYL TERT-BUTYL ETHER								
ETHYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ETHYLENE DIBROMIDE								
HEXACHLOROBUTADIENE								
ISOPROPYLBENZENE								
M,P-XYLENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
METHYLENE CHLORIDE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
METHYL-T-BUTYL ETHER	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
NAPHTHALENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
N-BUTYLBENZENE								
N-PROPYLBENZENE								
O-XYLENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
P-ISOPROPYLTOLUENE								
SEC-BUTYLBENZENE								
STYRENE								
TERT-AMYL METHYL ETHER								
TERT-BUTANOL								
TERT-BUTYLBENZENE								
TETRACHLOROETHENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TOLUENE	1.4	1	1 U	1 U	1 U	1 U	1	1.1
TRANS-1,2-DICHLOROETHENE	1 U	1.2	8.2	1 U	1 U	1 U	1 U	1 U
TRANS-1,3-DICHLOROPROPENE								
TRICHLOROETHENE	1 U	1 U	2300	1.2	1 U	1 U	1 U	18
TRICHLOROFLUOROMETHANE								
TRICHLOROTRIFLUOROETHANE								
VINYL ACETATE								
VINYL CHLORIDE	1 U	1.6	12	1 U	1 U	1 U	0.8 J	1 U
XYLENE (TOTAL)								

Notes:

UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP14	S21-DGS-DP14	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-VE03
Sample Code	385-S21-054A	385-S21-055	385-S21-056	385-S21-057	385-S21-058	385-S21-059	385-S21-060	385-S21-062
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/20/2001	8/20/2001	8/16/2001	8/16/2001	8/16/2001	8/16/2001	8/16/2001	8/21/2001
Sampling Depth (feet bgs)	17 - 19	25 - 27	15 -	20 -	30 -	40 -	50 -	6.5 -
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
1,1,1,2-TETRACHLOROETHANE		1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,1,1-TRICHLOROETHANE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,1,2-TRICHLOROETHANE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,1-DICHLOROETHANE	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,1-DICHLOROETHENE	0.8 J	1 U	1 U	1.6	1 U	1 U	1 U	10 U
1,1-DICHLOROPROPENE								
1,2,3-TRICHLOROBENZENE								
1,2,3-TRICHLOROPROPANE								
1,2,4-TRICHLOROBENZENE								
1,2,4-TRIMETHYLBENZENE								
1,2-DIBROMO-3-CHLOROPROPANE								
1,2-DICHLOROBENZENE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,2-DICHLOROETHANE	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,2-DICHLOROETHENE (TOTAL)	3							
1,2-DICHLOROPROPANE	2 U							
1,3,5-TRIMETHYLBENZENE								
1,3-DICHLOROBENZENE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
1,3-DICHLOROPROPANE								
1,4-DICHLOROBENZENE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
2,2-DICHLOROPROPANE								
2-BUTANONE	2 UJ							
2-CHLOROTOLUENE								
2-HEXANONE	2 UJ							
4-CHLOROTOLUENE								
4-METHYL-2-PENTANONE	2 UJ							
ACETONE	3 UJ							
BENZENE	0.5 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
BROMOBENZENE								
BROMOCHLOROMETHANE								
BROMODICHLOROMETHANE	2 U							
BROMOFORM	2 U							
BROMOMETHANE	2 U							
CARBON DISULFIDE	2 UJ							
CARBON TETRACHLORIDE	0.5 U							
CHLOROBENZENE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
CHLOROETHANE	2 UJ	1 U	1 U	1 U	1 U	1 U	1 U	10 U
CHLOROFORM	2 U							
CHLOROMETHANE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
CIS-1,2-DICHLOROETHENE		1 U	1 U	620	4.9	1 U	1 U	10 U
CIS-1,3-DICHLOROPROPENE	0.5 U							
DIBROMOCHLOROMETHANE	2 U							
DIBROMOMETHANE								
DICHLORODIFLUOROMETHANE								
DIISOPROPYL ETHER								
ETHYL TERT-BUTYL ETHER								
ETHYLBENZENE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
ETHYLENE DIBROMIDE								
HEXACHLOROBUTADIENE								
ISOPROPYLBENZENE								
M,P-XYLENE		1.4	1 U	1 U	1 U	1 U	1 U	10 U
METHYLENE CHLORIDE	2 UJ	1 U	1 U	1 U	1 U	1 U	1 U	10 U
METHYL-T-BUTYL ETHER	5 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U
NAPHTHALENE		1 U	1 U	1 U	1 U	1 U	1 U	10 U
N-BUTYLBENZENE								
N-PROPYLBENZENE								
O-XYLENE		1 U	1 U	1 U	1 U	1 U	1 U	10 U
P-ISOPROPYLTOLUENE								
SEC-BUTYLBENZENE								
STYRENE	2 U							
TERT-AMYL METHYL ETHER								
TERT-BUTANOL								
TERT-BUTYLBENZENE								
TETRACHLOROETHENE	2 U	1 U	1 U	5.3	1 U	1 U	1 U	10 U
TOLUENE	0.8 J	1.6	1 U	1 U	1 U	1 U	1 U	10 U
TRANS-1,2-DICHLOROETHENE		1 U	1 U	6	1 U	1 U	1 U	10 U
TRANS-1,3-DICHLOROPROPENE	0.5 U							
TRICHLOROETHENE	24	1 U	1 U	1900	1500	1.2	1 U	10 U
TRICHLOROFLUOROMETHANE								
TRICHLOROTRIFLUOROETHANE								
VINYL ACETATE								
VINYL CHLORIDE	0.5 U	1 U	1 U	4.1	1 U	1 U	1 U	10 U
XYLENE (TOTAL)	1 J							

Notes:

UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP15	S21-DGS-DP16	S21-DGS-DP16	S21-DGS-DP16	S21-DGS-DP17	S21-DGS-DP17	S21-DGS-DP19	S21-DGS-DP18
Sample Code	385-S21-063	385-S21-064	385-S21-065	385-S21-066	385-S21-067	385-S21-068	385-S21-073	385-S21-074
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/22/2001	8/24/2001	8/24/2001	8/24/2001	9/4/2001	9/4/2001	9/12/2001	9/12/2001
Sampling Depth (feet bgs)	15 -	8 - 10	15 - 17	20 - 22	9 - 11	14 - 16	14 - 16	8 - 10
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
1,1,1,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,1,1-TRICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,1,2-TRICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,1-DICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,1-DICHLOROETHENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,1-DICHLOROPROPENE							5 UJ	5 UJ
1,2,3-TRICHLOROBENZENE							5 UJ	5 UJ
1,2,3-TRICHLOROPROPANE							5 UJ	5 UJ
1,2,4-TRICHLOROBENZENE							5 UJ	5 UJ
1,2,4-TRIMETHYLBENZENE							5 UJ	5 UJ
1,2-DIBROMO-3-CHLOROPROPANE							5 UJ	5 UJ
1,2-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,2-DICHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,2-DICHLOROETHENE (TOTAL)								
1,2-DICHLOROPROPANE							5 UJ	5 UJ
1,3,5-TRIMETHYLBENZENE							5 UJ	5 UJ
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
1,3-DICHLOROPROPANE							5 UJ	5 UJ
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
2,2-DICHLOROPROPANE							5 UJ	5 UJ
2-BUTANONE							10 UJ	10 UJ
2-CHLOROTOLUENE							5 UJ	5 UJ
2-HEXANONE							10 UJ	10 UJ
4-CHLOROTOLUENE							5 UJ	5 UJ
4-METHYL-2-PENTANONE							10 UJ	10 UJ
ACETONE							20 UJ	20 UJ
BENZENE	1 U	1 U	1.1	1 U	1.7	1 U	5 UJ	5 UJ
BROMOBENZENE							5 UJ	5 UJ
BROMOCHLOROMETHANE							10 UJ	10 UJ
BROMODICHLOROMETHANE							5 UJ	5 UJ
BROMOFORM							5 UJ	5 UJ
BROMOMETHANE							10 UJ	10 UJ
CARBON DISULFIDE							5 UJ	5 UJ
CARBON TETRACHLORIDE							5 UJ	5 UJ
CHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
CHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	10 UJ	10 UJ
CHLOROFORM							5 UJ	5 UJ
CHLOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	10 UJ	10 UJ
CIS-1,2-DICHLOROETHENE	1 U	1 U	61	2.3	1 U	33	5 UJ	5 UJ
CIS-1,3-DICHLOROPROPENE							5 UJ	5 UJ
DIBROMOCHLOROMETHANE							5 UJ	5 UJ
DIBROMOMETHANE							5 UJ	5 UJ
DICHLORODIFLUOROMETHANE							10 UJ	10 UJ
DIISOPROPYL ETHER								
ETHYL TERT-BUTYL ETHER								
ETHYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
ETHYLENE DIBROMIDE							5 UJ	5 UJ
HEXACHLOROBUTADIENE							5 UJ	5 UJ
ISOPROPYLBENZENE							5 UJ	5 UJ
M,P-XYLENE	1 U	2.2	2.8	1 U	1 U	1 U	5 UJ	5 UJ
METHYLENE CHLORIDE	1 U	1 U	1 U	1 U	1 U	1 U	20 UJ	20 UJ
METHYL-T-BUTYL ETHER	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
NAPHTHALENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
N-BUTYLBENZENE							5 UJ	5 UJ
N-PROPYLBENZENE							5 UJ	5 UJ
O-XYLENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
P-ISOPROPYLTOLUENE							5 UJ	5 UJ
SEC-BUTYLBENZENE							5 UJ	5 UJ
STYRENE							5 UJ	5 UJ
TERT-AMYL METHYL ETHER								
TERT-BUTANOL								
TERT-BUTYLBENZENE							5 UJ	5 UJ
TETRACHLOROETHENE	1 U	1 U	1 U	1 U	1 U	1 U	5 UJ	5 UJ
TOLUENE	1 U	3.6	3.9	1 U	1 U	1 U	5 UJ	5 UJ
TRANS-1,2-DICHLOROETHENE	1 U	1.7	18	1 U	1 U	1 U	5 UJ	5 UJ
TRANS-1,3-DICHLOROPROPENE							5 UJ	5 UJ
TRICHLOROETHENE	1 U	1 U	1 U	8	1 U	1 U	5 UJ	5 UJ
TRICHLOROFLUOROMETHANE							5 UJ	5 UJ
TRICHLOROTRIFLUOROETHANE							5 UJ	5 UJ
VINYL ACETATE							50 UJ	50 UJ
VINYL CHLORIDE	1 U	3.7	70	1 U	1.9	1 U	10 UJ	10 UJ
XYLENE (TOTAL)								

Notes:

UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP18	S21-DGS-DP18	S21-DGS-DP03	S21-DGS-DP03	S21-DGS-DP19	S21-DGS-DP19	S21-DGS-DP101	S21-DGS-DP101
Sample Code	385-S21-075	385-S21-076	385-S21-077	385-S21-078	385-S21-081	385-S21-082	385-S21-101	385-S21-101A
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	9/12/2001	9/12/2001	9/12/2001	9/12/2001	11/5/2001	11/5/2001	8/29/2001	8/29/2001
Sampling Depth (feet bgs)	15 - 17	20 - 22	8 - 10	15 - 17	20 - 22	30 - 32	10 - 12	10 - 12
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
1,1,1,2-TETRACHLOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ				1 U
1,1,1-TRICHLOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
1,1,2,2-TETRACHLOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ	5 U	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
1,1-DICHLOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ	3 U	0.5 U	0.5	0.6 J
1,1-DICHLOROETHENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
1,1-DICHLOROPROPENE	5 UJ	5 UJ	5 UJ	5 UJ				
1,2,3-TRICHLOROBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
1,2,3-TRICHLOROPROPANE	5 UJ	5 UJ	5 UJ	5 UJ				
1,2,4-TRICHLOROBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
1,2,4-TRIMETHYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
1,2-DIBROMO-3-CHLOROPROPANE	5 UJ	5 UJ	5 UJ	5 UJ				
1,2-DICHLOROBENZENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
1,2-DICHLOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ	3 U	0.5 U	0.5 U	1 U
1,2-DICHLOROETHENE (TOTAL)					31	2 U	0.7 J	
1,2-DICHLOROPROPANE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	
1,3,5-TRIMETHYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
1,3-DICHLOROBENZENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
1,3-DICHLOROPROPANE	5 UJ	5 UJ	5 UJ	5 UJ				
1,4-DICHLOROBENZENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
2,2-DICHLOROPROPANE	5 UJ	5 UJ	5 UJ	5 UJ				
2-BUTANONE	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	2 UJ	2 UJ	
2-CHLOROTOLUENE	5 UJ	5 UJ	5 UJ	5 UJ				
2-HEXANONE	10 UJ	10 UJ	10 UJ	10 UJ	10 U	2 U	2 UJ	
4-CHLOROTOLUENE	5 UJ	5 UJ	5 UJ	5 UJ				
4-METHYL-2-PENTANONE	10 UJ	10 UJ	10 UJ	10 UJ	10 U	2 U	2 UJ	
ACETONE	20 UJ	20 UJ	20 UJ	20 UJ	16 UJ	3 UJ	3 UJ	
BENZENE	5 UJ	5 UJ	5 UJ	5 UJ	3 U	0.5 U	3	4.3
BROMOBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
BROMOCHLOROMETHANE	10 UJ	10 UJ	10 UJ	10 UJ				
BROMODICHLOROMETHANE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	
BROMOFORM	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	
BROMOMETHANE	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	2 UJ	2 U	
CARBON DISULFIDE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 UJ	
CARBON TETRACHLORIDE	5 UJ	5 UJ	5 UJ	5 UJ	3 U	0.5 U	0.5 U	
CHLOROBENZENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
CHLOROETHANE	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	2 UJ	2 UJ	1 U
CHLOROFORM	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	
CHLOROMETHANE	10 UJ	10 UJ	10 UJ	10 UJ	10 U	2 U	2 U	1 U
CIS-1,2-DICHLOROETHENE	49 J	5 UJ	5 UJ	10 J				1 U
CIS-1,3-DICHLOROPROPENE	5 UJ	5 UJ	5 UJ	5 UJ	3 U	0.5 U	0.5 U	
DIBROMOCHLOROMETHANE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	
DIBROMOMETHANE	5 UJ	5 UJ	5 UJ	5 UJ				
DICHLORODIFLUOROMETHANE	10 UJ	10 UJ	10 UJ	10 UJ				
DIISOPROPYL ETHER								
ETHYL TERT-BUTYL ETHER								
ETHYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
ETHYLENE DIBROMIDE	5 UJ	5 UJ	5 UJ	5 UJ				
HEXACHLOROBUTADIENE	5 UJ	5 UJ	5 UJ	5 UJ				
ISOPROPYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
M,P-XYLENE	5 UJ	5 UJ	5 UJ	5 UJ				1 U
METHYLENE CHLORIDE	20 UJ	20 UJ	20 UJ	20 UJ	10 UJ	2 UJ	2 UJ	1 U
METHYL-T-BUTYL ETHER	5 UJ	5 UJ	5 UJ	5 UJ	25 U	5 U	5 U	1 U
NAPHTHALENE	5 UJ	5 UJ	5 UJ	5 UJ				1 U
N-BUTYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
N-PROPYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
O-XYLENE	5 UJ	5 UJ	5 UJ	5 UJ				1 U
P-ISOPROPYLTOLUENE	5 UJ	5 UJ	5 UJ	5 UJ				
SEC-BUTYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
STYRENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	
TERT-AMYL METHYL ETHER								
TERT-BUTANOL								
TERT-BUTYLBENZENE	5 UJ	5 UJ	5 UJ	5 UJ				
TETRACHLOROETHENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	2 U	2 U	1 U
TOLUENE	5 UJ	5 UJ	5 UJ	5 UJ	10 U	0.7 J	2 U	1 U
TRANS-1,2-DICHLOROETHENE	6.1 J	5 UJ	6.1 J	5 J				1 U
TRANS-1,3-DICHLOROPROPENE	5 UJ	5 UJ	5 UJ	5 UJ	3 U	0.5 U	0.5 U	
TRICHLOROETHENE	5 UJ	5.9 J	5 UJ	5 UJ	420	2 U	2 U	1 U
TRICHLOROFLUOROMETHANE	5 UJ	5 UJ	5 UJ	5 UJ				
TRICHLOROTRIFLUOROETHANE	5 UJ	5 UJ	5 UJ	5 UJ				
VINYL ACETATE	50 UJ	50 UJ	50 UJ	50 UJ				
VINYL CHLORIDE	10 UJ	10 UJ	10 UJ	10 UJ	5 J	0.5 UJ	1	1.2
XYLENE (TOTAL)					10 U	0.3 J	2 U	

Notes:

UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP101	S21-DGS-DP101	S21-DGS-DP102	S21-DGS-DP102	S21-DGS-DP102	S21-DGS-DP102	S21-DGS-DP103
Sample Code	385-S21-102A	385-S21-103A	385-S21-104	385-S21-104A	385-S21-105A	385-S21-106A	385-S21-107A
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/27/2001
Sampling Depth (feet bgs)	25 - 27	50 - 52	10 - 12	10 - 12	25 - 27	50 - 52	10 -
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte							
1,1,1,2-TETRACHLOROETHANE	1 U	1 U		1 U	1 U	1 U	1 U
1,1,1-TRICHLOROETHANE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHANE	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHENE	1 U	1 U	2 UJ	1 U	1 U	1 U	1 U
1,1-DICHLOROPROPENE							
1,2,3-TRICHLOROBENZENE							
1,2,3-TRICHLOROPROPANE							
1,2,4-TRICHLOROBENZENE							
1,2,4-TRIMETHYLBENZENE							
1,2-DIBROMO-3-CHLOROPROPANE							
1,2-DICHLOROBENZENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHENE (TOTAL)			2 U				
1,2-DICHLOROPROPANE			2 U				
1,3,5-TRIMETHYLBENZENE							
1,3-DICHLOROBENZENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
1,3-DICHLOROPROPANE							
1,4-DICHLOROBENZENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
2,2-DICHLOROPROPANE							
2-BUTANONE			2 UJ				
2-CHLOROTOLUENE							
2-HEXANONE			2 UJ				
4-CHLOROTOLUENE							
4-METHYL-2-PENTANONE			2 UJ				
ACETONE			3 UJ				
BENZENE	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U
BROMOBENZENE							
BROMOCHLOROMETHANE							
BROMODICHLOROMETHANE			2 U				
BROMOFORM			2 U				
BROMOMETHANE			2 U				
CARBON DISULFIDE			2 UJ				
CARBON TETRACHLORIDE			0.5 U				
CHLOROBENZENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
CHLOROETHANE	1 U	1 U	2 UJ	1 U	1 U	1 U	1 U
CHLOROFORM			2 U				
CHLOROMETHANE	1 U	1 U	2 UJ	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	1 U	1 U		1 U	1 U	1 U	1 U
CIS-1,3-DICHLOROPROPENE			0.5 U				
DIBROMOCHLOROMETHANE			2 U				
DIBROMOMETHANE							
DICHLORODIFLUOROMETHANE							
DIISOPROPYL ETHER							
ETHYL TERT-BUTYL ETHER							
ETHYLBENZENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
ETHYLENE DIBROMIDE							
HEXACHLOROBUTADIENE							
ISOPROPYLBENZENE							
M,P-XYLENE	1 U	1 U		1 U	1 U	1 U	1 U
METHYLENE CHLORIDE	1 U	1 U	2 UJ	1 U	1 U	1 U	1 U
METHYL-T-BUTYL ETHER	1 U	1 U	5 U	1 U	1 U	1 U	1 U
NAPHTHALENE	1 U	1 U		1 U	1 U	1 U	1 U
N-BUTYLBENZENE							
N-PROPYLBENZENE							
O-XYLENE	1 U	1 U		1 U	1 U	1 U	1 U
P-ISOPROPYLTOLUENE							
SEC-BUTYLBENZENE							
STYRENE			2 U				
TERT-AMYL METHYL ETHER							
TERT-BUTANOL							
TERT-BUTYLBENZENE							
TETRACHLOROETHENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
TOLUENE	1.1 UJ	1.3 UJ	2 U	1 U	1.2 UJ	1 U	1 U
TRANS-1,2-DICHLOROETHENE	1 U	1 U		1 U	1 U	1 U	1 U
TRANS-1,3-DICHLOROPROPENE			0.5 U				
TRICHLOROETHENE	1 U	1 U	2 U	1 U	1 U	1 U	1 U
TRICHLOROFLUOROMETHANE							
TRICHLOROTRIFLUOROETHANE							
VINYL ACETATE							
VINYL CHLORIDE	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U
XYLENE (TOTAL)			2 U				

Notes:
UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP103	S21-DGS-DP103	S21-DGS-DP104	S21-DGS-DP104	S21-DGS-DP104	S21-DGS-DP105	S21-DGS-DP105
Sample Code	385-S21-108A	385-S21-109A	385-S21-111	385-S21-115	385-S21-118	385-S21-119A	385-S21-120A
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/27/2001	8/27/2001	9/19/2001	9/19/2001	9/19/2001	8/28/2001	8/28/2001
Sampling Depth (feet bgs)	25 -	50 -	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte							
1,1,1,2-TETRACHLOROETHANE	1 U	1 U				1 U	1 U
1,1,1-TRICHLOROETHANE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	1 U	1 U	2 U	2 U	2 U	1 U	1.4
1,1-DICHLOROETHANE	1 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U
1,1-DICHLOROETHENE	1 U	1 U	2 U	2 U	2 U	1 U	3.5
1,1-DICHLOROPROPENE							
1,2,3-TRICHLOROBENZENE							
1,2,3-TRICHLOROPROPANE							
1,2,4-TRICHLOROBENZENE							
1,2,4-TRIMETHYLBENZENE							
1,2-DIBROMO-3-CHLOROPROPANE							
1,2-DICHLOROBENZENE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
1,2-DICHLOROETHANE	1 U	1 U	0.5 U	0.5 U	0.5 U	1 U	1 U
1,2-DICHLOROETHENE (TOTAL)			2 U	0.6 J	0.3 J		
1,2-DICHLOROPROPANE			2 U	2 U	2 U		
1,3,5-TRIMETHYLBENZENE							
1,3-DICHLOROBENZENE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
1,3-DICHLOROPROPANE							
1,4-DICHLOROBENZENE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
2,2-DICHLOROPROPANE							
2-BUTANONE			2 UJ	2 U	2 U		
2-CHLOROTOLUENE							
2-HEXANONE			2 U	2 U	2 U		
4-CHLOROTOLUENE							
4-METHYL-2-PENTANONE			2 U	2 U	2 U		
ACETONE			10 UJ	3 UJ	4 UJ		
BENZENE	1 U	1 U	0.5 U	0.5 U	0.5 U	1.8	1.1
BROMOBENZENE							
BROMOCHLOROMETHANE							
BROMODICHLOROMETHANE			2 U	2 U	2 U		
BROMOFORM			2 U	2 U	2 U		
BROMOMETHANE			2 U	2 U	2 U		
CARBON DISULFIDE			2 U	2 U	0.6 J		
CARBON TETRACHLORIDE			0.5 UJ	0.5 UJ	0.5 UJ		
CHLOROBENZENE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
CHLOROETHANE	1 U	1 U	2 U	2 U	2 U	1 U	1.3
CHLOROFORM			2 U	2 U	2 U		
CHLOROMETHANE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	1 U	1 U				1 U	560
CIS-1,3-DICHLOROPROPENE			0.5 U	0.5 U	0.5 U		
DIBROMOCHLOROMETHANE			2 U	2 U	2 U		
DIBROMOMETHANE							
DICHLORODIFLUOROMETHANE							
DIISOPROPYL ETHER							
ETHYL TERT-BUTYL ETHER							
ETHYLBENZENE	1 U	1 U	2 U	2 U	2 U	1 U	2.3
ETHYLENE DIBROMIDE							
HEXACHLOROBUTADIENE							
ISOPROPYLBENZENE							
M,P-XYLENE	1 U	1 U				1 U	1 U
METHYLENE CHLORIDE	1 U	1 U	2 UJ	2 UJ	5 UJ	1 U	1 U
METHYL-T-BUTYL ETHER	1 U	1 U	5 U	5 U	5 U	1 U	1 U
NAPHTHALENE	1 U	1 U				1 U	1 U
N-BUTYLBENZENE							
N-PROPYLBENZENE							
O-XYLENE	1 U	1 U				1 U	1 U
P-ISOPROPYLTOLUENE							
SEC-BUTYLBENZENE							
STYRENE			2 U	2 U	2 U		
TERT-AMYL METHYL ETHER							
TERT-BUTANOL							
TERT-BUTYLBENZENE							
TETRACHLOROETHENE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
TOLUENE	1 U	1 U	2 U	2 U	2 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE	1 U	1 U				1 U	1.8
TRANS-1,3-DICHLOROPROPENE			0.5 U	0.5 U	0.5 U		
TRICHLOROETHENE	1 U	1 U	0.3 J	0.6 J	0.5 J	1 U	2900
TRICHLOROFLUOROMETHANE							
TRICHLOROTRIFLUOROETHANE							
VINYL ACETATE							
VINYL CHLORIDE	1 U	1 U	0.5 U	0.5 U	0.5 U	1 U	82
XYLENE (TOTAL)			2 U	2 U	2 U		

Notes:

UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP105	S21-DGS-DP106	S21-DGS-DP106	S21-DGS-DP106	398-L	398-MW1	398-MW1	398-MW1	398-MW1
Sample Code	385-S21-121A	385-S21-122A	385-S21-123A	385-S21-124A	398-L	398-MW1a	398-MW1b	398-MW1c	398-MW1d
Investigation	DGS	DGS	DGS	DGS	TPH	TPH	TPH	TPH	TPH
Sampling Date	8/28/2001	8/30/2001	8/30/2001	8/30/2001	4/27/1995	2/9/1995	12/17/1997	3/17/1998	9/30/199
Sampling Depth (feet bgs)	50 - 52	10 -	25 -	50 -	7 -	2.4 - 12.4	2.4 - 12.4	2.4 - 12.4	2.4 - 12.4
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte									
1,1,1,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U					
1,1,1-TRICHLOROETHANE	1 U	1 U	1 U	1 U					
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U					
1,1,2-TRICHLOROETHANE	1 U	1 U	1 U	1 U					
1,1-DICHLOROETHANE	1 U	1 U	1 U	1 U					
1,1-DICHLOROETHENE	1 U	1 U	1 U	1 U					
1,1-DICHLOROPROPENE									
1,2,3-TRICHLOROBENZENE									
1,2,3-TRICHLOROPROPANE									
1,2,4-TRICHLOROBENZENE									
1,2,4-TRIMETHYLBENZENE									
1,2-DIBROMO-3-CHLOROPROPANE									
1,2-DICHLOROBENZENE	1 U	1 U	1 U	1 U					
1,2-DICHLOROETHANE	1 U	1 U	1 U	1 U					
1,2-DICHLOROETHENE (TOTAL)									
1,2-DICHLOROPROPANE									
1,3,5-TRIMETHYLBENZENE									
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U					
1,3-DICHLOROPROPANE									
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U					
2,2-DICHLOROPROPANE									
2-BUTANONE									
2-CHLOROTOLUENE									
2-HEXANONE									
4-CHLOROTOLUENE									
4-METHYL-2-PENTANONE									
ACETONE									
BENZENE	1 U	1 U	1 U	1 U	10 U	10 U	0.5 U	0.5 U	0.5 U
BROMOBENZENE									
BROMOCHLOROMETHANE									
BROMODICHLOROMETHANE									
BROMOFORM									
BROMOMETHANE									
CARBON DISULFIDE									
CARBON TETRACHLORIDE									
CHLOROBENZENE	1 U	1 U	1 U	1 U					
CHLOROETHANE	1 U	1 U	1 U	1 U					
CHLOROFORM									
CHLOROMETHANE	1 U	1 U	1 U	1 U					
CIS-1,2-DICHLOROETHENE	2.5	1 U	1 U	1 U					
CIS-1,3-DICHLOROPROPENE									
DIBROMOCHLOROMETHANE									
DIBROMOMETHANE									
DICHLORODIFLUOROMETHANE									
DIISOPROPYL ETHER									
ETHYL TERT-BUTYL ETHER									
ETHYLBENZENE	1 U	1 U	1 U	1 U	10 U	10 U	0.5 U	0.5 U	0.5 U
ETHYLENE DIBROMIDE									
HEXACHLOROBUTADIENE									
ISOPROPYLBENZENE									
M,P-XYLENE	1 U	1 U	1 U	1 U					
METHYLENE CHLORIDE	1 U	1 U	1 U	1 U					
METHYL-T-BUTYL ETHER	1 U	1 U	1 U	1 U			2.5 U	2.5 U	2.5 U
NAPHTHALENE	1 U	1 U	1 U	1 U					
N-BUTYLBENZENE									
N-PROPYLBENZENE									
O-XYLENE	1 U	1 U	1 U	1 U					
P-ISOPROPYLTOLUENE									
SEC-BUTYLBENZENE									
STYRENE									
TERT-AMYL METHYL ETHER									
TERT-BUTANOL									
TERT-BUTYLBENZENE									
TETRACHLOROETHENE	1 U	1 U	1 U	1 U					
TOLUENE	1 U	1.3	1 U	1 U	10 U	10 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE	1 U	1.3	1 U	1 U					
TRANS-1,3-DICHLOROPROPENE									
TRICHLOROETHENE	6.7	1 U	1 U	1 U					
TRICHLOROFLUOROMETHANE									
TRICHLOROTRIFLUOROETHANE									
VINYL ACETATE									
VINYL CHLORIDE	1 U	7.1	1 U	1 U					
XYLENE (TOTAL)					13	10 U	0.5 U	0.5 U	0.5 U

Notes:
UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	398-MW1	398-MW2	398-MW2	398-MW2	398-MW2	398-MW2	398-5-MOJ	398-6-MOJ	398-7-MOJ	398-8-MOJ	398-9-MOJ
Sample Code	398-MW1e	398-MW2a	398-MW2b	398-MW2c	398-MW2d	398-MW2e	398-P5W	398-P6W	398-P7W	398-P8W	398-P9W
Investigation	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH
Sampling Date	4/6/1999	2/9/1995	12/17/1997	3/17/1998	9/28/1998	4/6/1999	9/2/1997	9/5/1997	9/5/1997	9/2/1997	9/2/1997
Sampling Depth (feet bgs)	2.4 - 12.4	2.6 - 12.6	2.6 - 12.6	2.6 - 12.6	2.6 - 12.6	2.6 - 12.6	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte											
1,1,1,2-TETRACHLOROETHANE											
1,1,1-TRICHLOROETHANE							4.9				
1,1,2,2-TETRACHLOROETHANE											
1,1,2-TRICHLOROETHANE											
1,1-DICHLOROETHANE							11		5.7		
1,1-DICHLOROETHENE											
1,1-DICHLOROPROPENE											
1,2,3-TRICHLOROBENZENE											
1,2,3-TRICHLOROPROPANE											
1,2,4-TRICHLOROBENZENE											
1,2,4-TRIMETHYLBENZENE											
1,2-DIBROMO-3-CHLOROPROPANE											
1,2-DICHLOROBENZENE											
1,2-DICHLOROETHANE							0.65	11			
1,2-DICHLOROETHENE (TOTAL)											
1,2-DICHLOROPROPANE								5.6	18		
1,3,5-TRIMETHYLBENZENE											
1,3-DICHLOROBENZENE											
1,3-DICHLOROPROPANE											
1,4-DICHLOROBENZENE											
2,2-DICHLOROPROPANE											
2-BUTANONE											
2-CHLOROTOLUENE											
2-HEXANONE											
4-CHLOROTOLUENE											
4-METHYL-2-PENTANONE											
ACETONE											
BENZENE	0.5 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOBENZENE											
BROMOCHLOROMETHANE											
BROMODICHLOROMETHANE											
BROMOFORM											
BROMOMETHANE											
CARBON DISULFIDE											
CARBON TETRACHLORIDE											
CHLOROBENZENE											
CHLOROETHANE											
CHLOROFORM											
CHLOROMETHANE											
CIS-1,2-DICHLOROETHENE								0.97	6.5		
CIS-1,3-DICHLOROPROPENE											
DIBROMOCHLOROMETHANE											
DIBROMOMETHANE											
DICHLORODIFLUOROMETHANE											
DIISOPROPYL ETHER											
ETHYL TERT-BUTYL ETHER											
ETHYLBENZENE	0.5 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLENE DIBROMIDE											
HEXACHLOROBUTADIENE											
ISOPROPYLBENZENE											
M,P-XYLENE											
METHYLENE CHLORIDE											
METHYL-T-BUTYL ETHER	2.5 U		2.5 U	2.5 U	2.5 U	2.5 U	5 U	5 U	5 U	5 U	5 U
NAPHTHALENE											
N-BUTYLBENZENE											
N-PROPYLBENZENE											
O-XYLENE											
P-ISOPROPYLTOLUENE											
SEC-BUTYLBENZENE											
STYRENE											
TERT-AMYL METHYL ETHER											
TERT-BUTANOL											
TERT-BUTYLBENZENE											
TETRACHLOROETHENE											
TOLUENE	0.5 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE									2.1		
TRANS-1,3-DICHLOROPROPENE											
TRICHLOROETHENE								3.2	12		
TRICHLOROFLUOROMETHANE											
TRICHLOROTRIFLUOROETHANE											
VINYL ACETATE											
VINYL CHLORIDE											
XYLENE (TOTAL)	0.5 U	10 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	1 U	1 U

Notes:
UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California
(Page 22 of 24)

Location	398-1-ERM	398-10-ERM	398-12-ERM	398-2-ERM	398-3-ERM	398-4-ERM	398-5-ERM	398-6-ERM	398-7-ERM	398-8-ERM
Sample Code	398-W1	398-W10	398-W12	398-W2	398-W3	398-W4	398-W5	398-W6	398-W7	398-W8
Investigation	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH
Sampling Date	1/11/1995	1/11/1995	1/16/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995
Sampling Depth (feet bgs)	-	-	-	-	-	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte										
1,1,1,2-TETRACHLOROETHANE										
1,1,1-TRICHLOROETHANE				0.8						
1,1,2,2-TETRACHLOROETHANE										
1,1,2-TRICHLOROETHANE										
1,1-DICHLOROETHANE				20.6	176	8.4	3.5		40.6	
1,1-DICHLOROETHENE										
1,1-DICHLOROPROPENE										
1,2,3-TRICHLOROBENZENE										
1,2,3-TRICHLOROPROPANE										
1,2,4-TRICHLOROBENZENE										
1,2,4-TRIMETHYLBENZENE										
1,2-DIBROMO-3-CHLOROPROPANE										
1,2-DICHLOROBENZENE										
1,2-DICHLOROETHANE									0.6	
1,2-DICHLOROETHENE (TOTAL)										
1,2-DICHLOROPROPANE						3.8				
1,3,5-TRIMETHYLBENZENE										
1,3-DICHLOROBENZENE										
1,3-DICHLOROPROPANE										
1,4-DICHLOROBENZENE										
2,2-DICHLOROPROPANE										
2-BUTANONE										
2-CHLOROTOLUENE										
2-HEXANONE										
4-CHLOROTOLUENE										
4-METHYL-2-PENTANONE										
ACETONE										
BENZENE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOBENZENE										
BROMOCHLOROMETHANE										
BROMODICHLOROMETHANE										
BROMOFORM										
BROMOMETHANE										
CARBON DISULFIDE										
CARBON TETRACHLORIDE										
CHLOROBENZENE										
CHLOROETHANE										
CHLOROFORM										
CHLOROMETHANE										
CIS-1,2-DICHLOROETHENE										
CIS-1,3-DICHLOROPROPENE										
DIBROMOCHLOROMETHANE										
DIBROMOMETHANE										
DICHLORODIFLUOROMETHANE										
DIISOPROPYL ETHER										
ETHYL TERT-BUTYL ETHER										
ETHYLBENZENE	0.5 U	16.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	27.4
ETHYLENE DIBROMIDE										
HEXACHLOROBUTADIENE										
ISOPROPYLBENZENE										
M,P-XYLENE										
METHYLENE CHLORIDE										
METHYL-T-BUTYL ETHER										
NAPHTHALENE										
N-BUTYLBENZENE										
N-PROPYLBENZENE										
O-XYLENE										
P-ISOPROPYLTOLUENE										
SEC-BUTYLBENZENE										
STYRENE										
TERT-AMYL METHYL ETHER										
TERT-BUTANOL										
TERT-BUTYLBENZENE										
TETRACHLOROETHENE										
TOLUENE	2.9	5.1	0.5 U	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	10.3
TRANS-1,2-DICHLOROETHENE										
TRANS-1,3-DICHLOROPROPENE										
TRICHLOROETHENE									1.5	
TRICHLOROFLUOROMETHANE										
TRICHLOROTRIFLUOROETHANE										
VINYL ACETATE										
VINYL CHLORIDE										
XYLENE (TOTAL)	1.7	1.5 U	1.5 U	1.5 U	21.8	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U

Notes:
UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	398-9-ERM	M07B-01	M07B-01	M07B-01	M07B-01	M11-06	M11-06	M11-06
Sample Code	398-W9	M07B-01	M07B-01-A1093	M07B-01-A1307	M07B-01-A1594	M11-06-A1097	M11-06-A1311	M11-06-A1598
Investigation	TPH	PH 2B&3 1991	GWM 2003	GWM 2003	GWM 2003	GWM 2003	GWM 2003	GWM 2003
Sampling Date	1/11/1995	8/21/1991	6/20/2002	9/6/2002	12/9/2002	6/20/2002	9/9/2002	12/9/2002
Sampling Depth (feet bgs)	-	-	-	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
1,1,1,2-TETRACHLOROETHANE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-TRICHLOROETHANE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE		1 U	0.5 UJ	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U
1,1-DICHLOROETHANE		1 U	0.4 J	0.5 J	0.4	0.2 J	0.2 J	0.5 U
1,1-DICHLOROETHENE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROPROPENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROPROPANE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-TRIMETHYLBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE			0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE		1 U	0.5 U	0.5 U	0.5 U	0.2 J	0.2 J	0.2
1,2-DICHLOROETHENE (TOTAL)		8.3						
1,2-DICHLOROPROPANE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3,5-TRIMETHYLBENZENE			0.4 U	0.5 U	0.5 U	0.4 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-DICHLOROPROPANE			0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U
1,4-DICHLOROBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2,2-DICHLOROPROPANE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-BUTANONE		2 U	10 UJ	10 U	10 UJ	10 UJ	10 U	10 UJ
2-CHLOROTOLUENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-HEXANONE		2 U	10 U	10 U	10 U	10 U	10 U	10 U
4-CHLOROTOLUENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
4-METHYL-2-PENTANONE		2 U	10 UJ	10 U	10 U	10 UJ	10 U	10 U
ACETONE		2.7 UJ	10 UJ	1.2 U	10 UJ	10 UJ	1.2 UJ	0.5 UJ
BENZENE	0.5 U	1.5	0.5 U	0.5 U	0.5 U	0.2 J	0.5 U	0.5 U
BROMOBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOCHLOROMETHANE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMODICHLOROMETHANE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
BROMOFORM		1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U
BROMOMETHANE		1 U	1 U	1 U	1 U	1 U	1 U	1 U
CARBON DISULFIDE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE		1 U	1 U	1 U	1 U	0.5 J	0.7 J	1 U
CHLOROFORM		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE		1 U	1 U	1 U	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE			4.6	5.4	5.3	0.5 J	0.5	0.5
CIS-1,3-DICHLOROPROPENE		1 U						
DIBROMOCHLOROMETHANE		1 U	0.5 UJ	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U
DIBROMOMETHANE			0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE			1 U	1 U	1 U	1 U	1 U	1 U
DIISOPROPYL ETHER			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYL TERT-BUTYL ETHER			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ETHYLBENZENE	278.8	1 U	0.2 U	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U
ETHYLENE DIBROMIDE		0.02 U	0.5 UJ	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U
HEXACHLOROBUTADIENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
ISOPROPYLBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
M,P-XYLENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE		1 U	5 U	0.1 U	5 UJ	5 U	0.2 U	5 UJ
METHYL-T-BUTYL ETHER			0.2 UJ	0.2 U	0.5 U	0.2 UJ	0.2 U	0.5 U
NAPHTHALENE			2 UJ	2 U	2 U	2 UJ	2 U	2 U
N-BUTYLBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
N-PROPYLBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
O-XYLENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
P-ISOPROPYLTOLUENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SEC-BUTYLBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
STYRENE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TERT-AMYL METHYL ETHER			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TERT-BUTANOL			20 U	20 U	10 U	20 U	20 U	10 U
TERT-BUTYLBENZENE			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TETRACHLOROETHENE		1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TOLUENE	0.5 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE			0.3 J	0.3 J	0.2	0.3 J	0.2 J	0.2
TRANS-1,3-DICHLOROPROPENE		1 U						
TRICHLOROETHENE		1 U	0.5 U	0.2 J	0.2	0.5 U	0.4 J	0.8
TRICHLOROFLUOROMETHANE			1 U	1 U	1 U	1 U	1 U	1 U
TRICHLOROTRIFLUOROETHANE								
VINYL ACETATE		1 U						
VINYL CHLORIDE		1.8	0.4 J	0.5 J	0.5 U	4.2	2.3	4.2
XYLENE (TOTAL)	17.4	1 U						

Notes:
UG/L Micrograms per liter

TABLE D-130: SITE 21 VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	WA-8	WA-8	WA-8	WA-8
Sample Code	WA-8	WA-8-A1104	WA-8-A1318	WA-8-A1605
Investigation	PH 2B&3 1991	GWM 2003	GWM 2003	GWM 2003
Sampling Date	9/4/1991	6/20/2002	9/6/2002	12/9/2002
Sampling Depth (feet bgs)	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L
Analyte				
1,1,1,2-TETRACHLOROETHANE		0.5 U	0.5 U	0.5 U
1,1,1-TRICHLOROETHANE	1 U	0.5 U	0.5 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	1 U	0.5 U	0.5 U	0.5 U
1,1,2-TRICHLOROETHANE	1 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROETHANE	1 U	0.2 J	0.5 U	0.5 U
1,1-DICHLOROETHENE	1 U	0.5 U	0.5 U	0.5 U
1,1-DICHLOROPROPENE		0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROBENZENE		0.5 U	0.5 U	0.5 U
1,2,3-TRICHLOROPROPANE		0.5 U	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE		0.5 U	0.5 U	0.5 U
1,2,4-TRIMETHYLBENZENE		0.5 U	0.5 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE		0.5 U	0.5 U	0.5 U
1,2-DICHLOROBENZENE		0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHANE	1 U	0.5 U	0.5 U	0.5 U
1,2-DICHLOROETHENE (TOTAL)	1 U			
1,2-DICHLOROPROPANE	1 U	0.5 U	0.5 U	0.5 U
1,3,5-TRIMETHYLBENZENE		0.4 U	0.5 U	0.5 U
1,3-DICHLOROBENZENE		0.5 U	0.5 U	0.5 U
1,3-DICHLOROPROPANE		0.5 U	0.5 U	0.5 U
1,4-DICHLOROBENZENE		0.5 U	0.5 U	0.5 U
2,2-DICHLOROPROPANE		0.5 U	0.5 U	0.5 U
2-BUTANONE	2 U	10 U	10 U	10 UJ
2-CHLOROTOLUENE		0.5 U	0.5 U	0.5 U
2-HEXANONE	2 U	10 U	10 U	10 U
4-CHLOROTOLUENE		0.5 U	0.5 U	0.5 U
4-METHYL-2-PENTANONE	2 U	10 U	10 U	10 U
ACETONE	3.4 UJ	1.2 J	0.8 U	0.7 J
BENZENE	1 U	0.5 U	0.5 U	0.5 U
BROMOBENZENE		0.5 U	0.5 U	0.5 U
BROMOCHLOROMETHANE		0.5 U	0.5 U	0.5 U
BROMODICHLOROMETHANE	1 U	0.5 U	0.5 U	0.5 U
BROMOFORM	1 U	1 U	1 U	1 U
BROMOMETHANE	1 U	1 U	1 U	1 U
CARBON DISULFIDE	1 U	0.5 U	0.5 U	0.5 U
CARBON TETRACHLORIDE	1 U	0.5 U	0.5 U	0.5 U
CHLOROBENZENE	1 U	0.5 U	0.5 U	0.5 U
CHLOROETHANE	1 U	1 U	1 U	1 U
CHLOROFORM	1 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	1 U	1 U	1 U	0.3
CIS-1,2-DICHLOROETHENE		0.5 U	0.5 U	0.5 U
CIS-1,3-DICHLOROPROPENE	1 U			
DIBROMOCHLOROMETHANE	1 U	0.5 U	0.5 U	0.5 U
DIBROMOMETHANE		0.5 U	0.5 U	0.5 U
DICHLORODIFLUOROMETHANE		1 U	1 U	1 U
DIISOPROPYL ETHER		0.5 U	0.5 U	0.5 U
ETHYL TERT-BUTYL ETHER		0.5 U	0.5 U	0.5 U
ETHYLBENZENE	1 U	0.2 U	0.5 U	0.5 U
ETHYLENE DIBROMIDE	0.02 U	0.5 U	0.5 U	0.5 U
HEXACHLOROBUTADIENE		0.5 U	0.5 U	0.5 U
ISOPROPYLBENZENE		0.5 U	0.5 U	0.5 U
M,P-XYLENE		0.5 U	0.5 U	0.5 U
METHYLENE CHLORIDE	1 U	5 U	5 U	5 UJ
METHYL-T-BUTYL ETHER		0.1 J	0.5 U	0.5 U
NAPHTHALENE		2 U	2 U	2 U
N-BUTYLBENZENE		0.5 U	0.5 U	0.5 U
N-PROPYLBENZENE		0.5 U	0.5 U	0.5 U
O-XYLENE		0.5 U	0.5 U	0.5 U
P-ISOPROPYLTOLUENE		0.5 U	0.5 U	0.5 U
SEC-BUTYLBENZENE		0.5 U	0.5 U	0.5 U
STYRENE	1 U	0.5 U	0.5 U	0.5 U
TERT-AMYL METHYL ETHER		0.5 U	0.5 U	0.5 U
TERT-BUTANOL		6.6 J	2.7 J	3.4
TERT-BUTYLBENZENE		0.5 U	0.5 U	0.5 U
TETRACHLOROETHENE	1 U	0.5 U	0.5 U	0.5 U
TOLUENE	1 U	0.5 U	0.5 U	0.5 U
TRANS-1,2-DICHLOROETHENE		0.5 U	0.5 U	0.5 U
TRANS-1,3-DICHLOROPROPENE	1 U			
TRICHLOROETHENE	1 U	0.5 U	0.5 U	0.5 U
TRICHLOROFLUOROMETHANE		1 U	1 U	1 U
TRICHLOROTRIFLUOROETHANE				
VINYL ACETATE	1 U			
VINYL CHLORIDE	1 U	0.5 U	0.5 U	0.5 U
XYLENE (TOTAL)	1 U			

Notes:
UG/L Micrograms per liter

TABLE D-131: SITE 21 DISSOLVED METALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	CA03-01	CA11-20	M11-06	M11-06	M11-06	M11-06	M07B-01	M07B-01	M07B-01	M07B-01
Sample Code	030-CAP-006	030-CAP-166	108-S11-002	108-S11-010	108-S11-014	108-S11-019	108-S21-001	108-S21-002	108-S21-003	108-S21-004
Investigation	TPH	TPH	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998
Sampling Date	4/27/2000	4/28/2000	11/5/1997	2/6/1998	5/12/1998	8/7/1998	11/5/1997	2/13/1998	5/13/1998	8/7/1998
Sampling Depth (feet bgs)	0 - 10	3 - 8	-	-	-	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte										
ALUMINUM			50.4 UJ	27.7 UJ	337	7.4 U	21.9 UJ	33.8 UJ	308	7.4 U
ANTIMONY			0.8 UJ	0.7 U	0.85 U	2.7 UJ	0.76 UJ	1 J	0.85 U	2.7 UJ
ARSENIC			4 UJ	1.5 J	1.1 J	4 UJ	15.1	6.1 UJ	3.7 J	14.1
BARIUM			43.1 J	55.3 J	292	70.2 J	217	30.7 J	300	77.9 J
BERYLLIUM			0.15 U	0.1 U	0.1 U	0.2 U	0.15 U	0.1 U	0.1 U	0.2 U
CADMIUM			0.15 U	0.2 U	0.4 UJ	0.3 UJ	0.15 U	0.2 U	0.15 U	0.36 J
CALCIUM			11900	36800	35100	28000	45300	12600	21400	21000
CHROMIUM			3.4 J	1.8 J	1.8 J	1.2 J	0.92 UJ	0.55 J	1.2 J	0.8 U
COBALT			0.4 U	0.25 U	0.3 U	2.5 UJ	0.4 U	0.25 U	0.3 U	4.1 J
COPPER			1.2 J	0.35 UJ	2.9 UJ	4.3 UJ	0.65 U	0.35 UJ	2.8 UJ	2.4 UJ
IRON			52.9	8.4 UJ	237	12.5 U	5.6 U	23.7 UJ	247	12.5 U
LEAD	3 U	34	0.65 U	0.6 U	6.9 UJ	1.7 U	0.65 U	0.6 U	0.5 UJ	1.7 U
MAGNESIUM			10100	20900	19000	15300	33400	6620	9260	10600
MANGANESE			86.7	22.5	78.6	103	263	1.5 UJ	9.9	77.6
MERCURY			0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
MOLYBDENUM			2.2 UJ	2.6 J	2.9 J	2.8 J	4.2 J	2.2 UJ	2.1 J	5.4
NICKEL			2.4 J	1.1 UJ	1.8 J	1.3 UJ	2 J	1.1 UJ	1.5 J	1.5 UJ
POTASSIUM			27400 J	12100 J	17700 J	16700	46100 J	4920 J	6310 J	13600
SELENIUM			1.4 J	0.8 UJ	0.85 UJ	2.2 UJ	1 U	0.9 U		2.2 UJ
SILVER			0.44 UJ	0.15 UJ	0.3 U	0.7 U	0.54 UJ	0.15 UJ	0.3 U	0.7 U
SODIUM			207000 J	75400	96400	125000	346000 J	25400	26800	118000
THALLIUM			1.2 U	1.4 U	1.4 UJ	1.1 U	1.2 U	1.4 U	1.4 U	1.1 U
VANADIUM			12.8 J	3.9 UJ	3.3 UJ	4.2 J	7.2 J	5.9 UJ	5.3 J	7.2 J
ZINC			9.7 UJ	7.8 UJ	93.4	7.8 J	9.4 UJ	3.2 UJ	88.1	1.9 UJ

Notes:

UG/L Micrograms per liter

TABLE D-131: SITE 21 DISSOLVED METALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	M07B-01	M07B-01	M07B-01	DHP-S07B-01	DHP-S07B-02	M11-06	M11-06	M11-06	M11-06
Sample Code	280-S7B11-051	280-S7B11-053	280-S7B11-054	280-S7B11-083	280-S7B11-084	280-S7B11-117	280-S7B11-154	280-S7B11-155	280-S7B11-156
Investigation	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994
Sampling Date	11/1/1994	6/16/1995	8/23/1995	8/4/1994	8/4/1994	11/29/1994	2/16/1995	6/19/1995	8/29/1995
Sampling Depth (feet bgs)	-	-	-	28.5 -	26.3 -	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte									
ALUMINUM	28.2 U	20.7 U	15.7 UJ	84.8 U	84.8 U	28.2 U	40.8 U	20.7 U	42.4 UJ
ANTIMONY	3.3 U	6.4 U	5.6 U	12.7 J	4.6 U	3.3 U	2.2 U	6.6 UJ	5.6 U
ARSENIC	10.3	7.8 UJ	7.8 J	13 UJ	5.2 U	6.4 J	5 U	5.5 UJ	2.8 U
BARIUM	224	59.3 J	130 J	88.6 J	93.4 J	14.6 J	43.7 J	29.7 UJ	30.4 J
BERYLLIUM	1 U	0.7 U	0.1 U	3.6 J	3.4 J	1.1 J	0.8 U	0.7 U	0.1 U
CADMIUM	0.3 U	0.3 U	0.3 U	4.1 J	0.8 U	0.3 U	0.4 U	0.3 U	0.3 U
CALCIUM	54800	16100 J	30600	464000	300000	19700	38900	21500 J	15100
CHROMIUM	0.6 U	0.7 U	1 U	2 UJ	0.8 U	2.8 UJ	1.6 U	0.7 U	1 U
COBALT	7.7 U	4.6 U	3.8 U	114	46.5 J	7.7 U	5.6 U	4.6 U	3.8 U
COPPER	5.4 UJ	7.5 UJ	12 U	10.1 J	8 U	7.9 UJ	52.6 UJ	5.2 UJ	12 U
IRON	15.6 J	51 UJ	30.7 UJ	6090	8490	37.6 UJ	6.7 U	27.9 UJ	52.3 UJ
LEAD	1.5 U	1.3 U	1.1 U	6 UJ	2.4 U	1.5 U	1 U	1.3 U	1.1 U
MAGNESIUM	43400	11900 J	23300	1510000	957000	15800	23800	14900 J	13300
MANGANESE	333	107	196	7240	4370	135	164	129	114
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MOLYBDENUM	12.7 U	12.9 UJ	8.3 UJ	28 UJ	28 U	12.7 U	9.6 U	9.8 U	7.9 U
NICKEL	9.3 U	9.3 U	7.5 U	273 J	119 J	9.3 U	11.3 U	9.3 U	7.5 U
POTASSIUM	36800	16100	25100	729000 J	564000 J	17600	17700	16400	18700
SELENIUM	3 U	2.6 U	2.4 U	13.5 UJ	5.4 U	3 U	2.7 U	2.6 U	2.4 U
SILVER	1.4 UJ	0.9 U	0.9 U	4.5 UJ	1.8 U	1.4 U	2 U	0.9 U	0.9 U
SODIUM	404000	168000 J	242000	13900000	10900000	194000	139000	124000 J	165000
THALLIUM	2.3 U	2.9 U	3.4 U	10 UJ	4 U	2.3 U	3.8 U	2.9 U	3.4 U
VANADIUM	7 U	7.7 UJ	3.7 U	13.6 UJ	13.6 U	9.5 J	10.8 UJ	7.6 UJ	8.9 UJ
ZINC	18 J	5.3 U	13.1 U	1460 J	1040 J	25.4 UJ	24.5 UJ	20 UJ	13.1 U

Notes:

UG/L Micrograms per liter

TABLE D-131: SITE 21 DISSOLVED METALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	M07B-01	M07B-01	M07B-01	M11-06	M11-06	WA-8	WA-8	WA-8
Sample Code	M07B-01	M07B-01-A1093	M07B-01-A1594	M11-06-A1097	M11-06-A1598	WA-8	WA-8-A1104	WA-8-A1605
Investigation	PH 2B&3 1991	GWM 2003	GWM 2003	GWM 2003	GWM 2003	PH 2B&3 1991	GWM 2003	GWM 2003
Sampling Date	8/21/1991	6/20/2002	12/9/2002	6/20/2002	12/9/2002	9/4/1991	6/20/2002	12/9/2002
Sampling Depth (feet bgs)	-	-	-	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
ALUMINUM	31 U	80 J	6.4 U	100 U	11 U		970 J	8.2 U
ANTIMONY	25.1 U	0.27 J	0.11 U	50 U	0.11 U	25.1 U	0.55 J	0.4 U
ARSENIC	9.4	7.4	7.9	1.9 U	2.7	9.4	11	5.7
BARIUM	47.1	120 J	160	52 J	43		210 J	170
BERYLLIUM	1.3 U	2 U	2 U	2 U	2 U		2 U	2 U
CADMIUM	3 U	5 U	5 U	5 U	5 U		5 U	5 U
CALCIUM	16400	41000	51000	21000	20000	54800 J	83000	53000
CHROMIUM	5.7 U	10 U	0.57 U	10 U	1.6 U		10 U	1.1 U
COBALT	6.1 U	0.23 J	0.21	0.068 J	0.13		0.34 J	0.5
COPPER	40.1	0.54 J	0.29	0.83 J	0.43		0.67 J	0.62
IRON	12.6	58 J	300	140	270	169	4000	2200
LEAD	2 U	0.13 J	0.37 U	0.3 J	0.72 U	2 UJ	0.064 J	0.95 U
MAGNESIUM	13200	20000 J	29000	16000 J	18000	67500	60000 J	43000
MANGANESE	98.2	92 J	190	130 J	180	932	1400 J	750
MERCURY	0.2 U	0.041 J	0.21 U	0.2 U	0.12 U	0.2 U	0.2 U	0.13 U
MOLYBDENUM		3.1 J	3.7	1.4 J	1.7		1.9 J	2.3
NICKEL	13.2 U	0.71 J	1.2	0.42 J	0.69	13.2 U	2 J	2.4
POTASSIUM	23800	13000	18000	14000	16000	59500	32000	34000
SELENIUM	2.1 UJ	5 U	0.95	0.5 J	0.75	2.1 UJ	1.5 J	1.5
SILVER	4.9 UJ	5 U	0.1 U	5 U	0.14 U		5 U	0.044 U
SODIUM	232000	130000	210000	160000	210000	1300000 J	530000	500000
THALLIUM	2.7 U	2 U	0.065 U	2 U	2 U	2.7 U	0.1 U	2 U
VANADIUM	5.1	10 U	1.4 U	10 U	3.6 U	13.8	10 U	3.2 U
ZINC	6.3	9.6 J	0.85 UJ	10 J	12 UJ	5.7	1.3 J	8.6 UJ

Notes:

UG/L Micrograms per liter

TABLE D-132: SITE 21 TOTAL METALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California
(Page 1 of 1)

Location	398-L
Sample Code	398-L
Investigation	TPH
Sampling Date	4/27/1995
Sampling Depth (feet bgs)	7 -
Units	UG/L
Analyte	
LEAD	0 U

Notes:
UG/L Micrograms per liter

TABLE D-133: SITE 21 TOTAL PETROLEUM HYDROCARBONS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	CA03-01	CA11-20	03GB032	126-003-009	M07B-01	M07B-01	M07B-01	DHP-S07B-01
Sample Code	030-CAP-006	030-CAP-166	03GPW032	126-0020	280-S7B11-051	280-S7B11-053	280-S7B11-054	280-S7B11-083
Investigation	TPH	TPH	FO 1994	EBS PHASE 2B	FO 1994	FO 1994	FO 1994	FO 1994
Sampling Date	4/27/2000	4/28/2000	9/12/1994	10/31/1995	11/1/1994	6/16/1995	8/23/1995	8/4/1994
Sampling Depth (feet bgs)	0 - 10	3 - 8	10 - 12	8 - 9	-	-	-	28.5 -
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS	100 U	290	100 U	100 U	100 U	100 U	100 U	100 U
GASOLINE RANGE ORGANICS	50 U	9000	50 U	50 UJ	50 U	50 U	50 U	50 U
JP5 RANGE ORGANICS		100	100 U		100 U	100 U	100 U	100 U
MOTOR OIL RANGE ORGANICS	500 U	500 U	600 J	200 U	370 J	270 J	500 U	520 J

Location	DHP-S07B-02	M11-06	M11-06	M11-06	M11-06	M11-06	S21-DGS-DP07	WA-8
Sample Code	280-S7B11-084	280-S7B11-117	280-S7B11-15	280-S7B11-155	280-S7B11-156	385-S11-011	385-S21-020	385-S21-022
Investigation	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	DGS	DGS	DGS
Sampling Date	8/4/1994	11/29/1994	2/16/1995	6/19/1995	8/29/1995	7/3/2001	7/31/2001	7/9/2001
Sampling Depth (feet bgs)	26.3 -	-	-	-	-	-	5 - 7	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	MG/L	UG/L	MG/L
Analyte								
DIESEL RANGE ORGANICS	100 U	100 U	100 U	100 U	100 U	0.1 U	200 UJ	0.22 DM
GASOLINE RANGE ORGANICS	50 U	50 U	50 U	50 U	50 UJ	0.05 U	120000 J	0.03 J
JP5 RANGE ORGANICS	100 U	100 U	100 U	100 U	100 U	0.1 U		0.1 U
MOTOR OIL RANGE ORGANICS	1000 J	500 U	500 U	320 J	500 U	0.1 U	200 UJ	0.1 U

Location	M07B-01	398-MW1	398-MW2	S21-DGS-VE01	S21-DGS-VE01	S21-DGS-VE02	OUTFALL G	S21-DGS-DP11
Sample Code	385-S21-023	385-S21-024	385-S21-025	385-S21-030	385-S21-030A	385-S21-033	385-S21-035	385-S21-056
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	6/26/2001	6/26/2001	6/26/2001	8/7/2001	8/7/2001	8/7/2001	7/20/2001	8/16/2001
Sampling Depth (feet bgs)	-	-	-	8 - 9	8 - 9	8.5 - 9.2	0 -	15 -
Units	MG/L	MG/L	MG/L	UG/L	MG/L	UG/L	MG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS	0.1 U	0.1 U	0.1 U	1400	42 D	310	0.1 U	
GASOLINE RANGE ORGANICS		0.05 UJ	0.05 UJ	1800 J	5.18 J	12000 J	0.05 U	600
JP5 RANGE ORGANICS	0.1 U	0.1 U	0.1 U		5 U		0.1 U	
MOTOR OIL RANGE ORGANICS	0.1 U	0.1 U	0.1 U	200 U	68 M	200 U	0.4 M	

Notes:

MG/L Milligrams per liter

UG/L Micrograms per liter

TABLE D-133: SITE 21 TOTAL PETROLEUM HYDROCARBONS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-DP11	S21-DGS-VE03	S21-DGS-DP15	S21-DGS-DP16	S21-DGS-DP16
Sample Code	385-S21-057	385-S21-058	385-S21-059	385-S21-060	385-S21-062	385-S21-063	385-S21-064	385-S21-065
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/16/2001	8/16/2001	8/16/2001	8/16/2001	8/21/2001	8/22/2001	8/24/2001	8/24/2001
Sampling Depth (feet bgs)	20 -	30 -	40 -	50 -	6.5 -	15 -	8 - 10	15 - 17
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS					560			
GASOLINE RANGE ORGANICS	1500	1200	660	63	36000 J	1100 J	50 U	90 J
JP5 RANGE ORGANICS								
MOTOR OIL RANGE ORGANICS					200 U			

Location	S21-DGS-DP16	S21-DGS-DP18	S21-DGS-DP18	S21-DGS-DP18	S21-DGS-DP03	S21-DGS-DP03	398-L	398-MW1
Sample Code	385-S21-066	385-S21-074	385-S21-075	385-S21-076	385-S21-077	385-S21-078	398-L	398-MW1
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	TPH	TPH
Sampling Date	8/24/2001	9/12/2001	9/12/2001	9/12/2001	9/12/2001	9/12/2001	4/27/1995	2/9/1995
Sampling Depth (feet bgs)	20 - 22	8 - 10	15 - 17	20 - 22	8 - 10	15 - 17	7 -	2.4 - 12.4
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS							220000	50 U
GASOLINE RANGE ORGANICS	50 U	50 U	50 U	50 U	50 U	50 U	34000	50 U
JP5 RANGE ORGANICS							0 U	
MOTOR OIL RANGE ORGANICS							0 U	

Location	398-MW1	398-MW1	398-MW1	398-MW1	398-MW2	398-MW2	398-MW2	398-MW2
Sample Code	398-MW1	398-MW1	398-MW1	398-MW1	398-MW2	398-MW2	398-MW2	398-MW2
Investigation	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH
Sampling Date	12/17/1997	3/17/1998	9/30/1998	4/6/1999	2/9/1995	12/17/1997	3/17/1998	9/28/1998
Sampling Depth (feet bgs)	2.4 - 12.4	2.4 - 12.4	2.4 - 12.4	2.4 - 12.4	2.6 - 12.6	2.6 - 12.6	2.6 - 12.6	2.6 - 12.6
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS	50 U	50 U	50 U	50 U	180	160	260	190
GASOLINE RANGE ORGANICS	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
JP5 RANGE ORGANICS	50 U	50 U	50 U	50 U		62	110	
MOTOR OIL RANGE ORGANICS	250 U	250 U	250 U	250 U		250 U	250 U	250 U

Notes:

UG/L Micrograms per liter

TABLE D-133: SITE 21 TOTAL PETROLEUM HYDROCARBONS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	398-MW2	398-3-MOJ	398-5-MOJ	398-6-MOJ	398-7-MOJ	398-8-MOJ	398-9-MOJ	398-1-ERM
Sample Code	398-MW2	398-P3W	398-P5W	398-P6W	398-P7W	398-P8W	398-P9W	398-W1
Investigation	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH
Sampling Date	4/6/1999	9/4/1997	9/2/1997	9/5/1997	9/5/1997	9/2/1997	9/2/1997	1/11/1995
Sampling Depth (feet bgs)	2.6 - 12.6	-	-	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS	220	520	660	540	980	920	800	3933
GASOLINE RANGE ORGANICS	50 U		67	87	50 U	50 U	50 U	500 U
JP5 RANGE ORGANICS	50 U	500 U	500 U	670 U	530 U	500 U	500 U	
MOTOR OIL RANGE ORGANICS	250 U							

Location	398-10-ERM	398-12-ERM	398-2-ERM	398-3-ERM	398-4-ERM	398-5-ERM	398-6-ERM	398-7-ERM
Sample Code	398-W10	398-W12	398-W2	398-W3	398-W4	398-W5	398-W6	398-W7
Investigation	TPH	TPH	TPH	TPH	TPH	TPH	TPH	TPH
Sampling Date	1/11/1995	1/16/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995	1/11/1995
Sampling Depth (feet bgs)	-	-	-	-	-	-	-	-
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS	500 U	500 U	500 U	2029000	500 U	500 U	266500	500 U
GASOLINE RANGE ORGANICS	194200	500 U	500 U	500 U	500 U	500 U	500 U	500 U
JP5 RANGE ORGANICS								
MOTOR OIL RANGE ORGANICS								

Location	398-8-ERM	398-9-ERM	M07B-01	M07B-01	M07B-01	M07B-01	M11-06	M11-06
Sample Code	398-W8	398-W9	M07B-01	M07B-01-A1093	M07B-01-A1307	M07B-01-A1594	M11-06-A1097	M11-06-A1311
Investigation	TPH	TPH	PH 2B&3 1991	GWM 2003	GWM 2003	GWM 2003	GWM 2003	GWM 2003
Sampling Date	1/11/1995	1/11/1995	8/21/1991	6/20/2002	9/6/2002	12/9/2002	6/20/2002	9/9/2002
Sampling Depth (feet bgs)	-	-	-	-	-	-	-	-
Units	UG/L	UG/L	MG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
DIESEL RANGE ORGANICS	500 U	500 U		50 U	50 U	50 U	50 U	50 U
GASOLINE RANGE ORGANICS	158800	1332000		50 U	30 U	12	50 U	14 U
JP5 RANGE ORGANICS				50 U	50 U	50 U	50 U	50 U
MOTOR OIL RANGE ORGANICS				300 U	300 U	300 U	300 U	300 U
TRPH			0.18 U					

Notes:

MG/L Milligrams per liter

TRPH Total recoverable petroleum hydrocarbons

UG/L Micrograms per liter

TABLE D-133: SITE 21 TOTAL PETROLEUM HYDROCARBONS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	M11-06	WA-8	WA-8	WA-8	WA-8
Sample Code	M11-06-A1598	WA-8	WA-8-A1104	WA-8-A1318	WA-8-A1605
Investigation	GWM 2003	PH 2B&3 1991	GWM 2003	GWM 2003	GWM 2003
Sampling Date	12/9/2002	9/4/1991	6/20/2002	9/6/2002	12/9/2002
Sampling Depth (feet bgs)	-	-	-	-	-
Units	UG/L	MG/L	UG/L	UG/L	UG/L
Analyte					
DIESEL RANGE ORGANICS	50 U		50 U	50 U	50 U
GASOLINE RANGE ORGANICS	50 U		50 U	23 U	50 U
JP5 RANGE ORGANICS	50 U		50 U	50 U	50 U
MOTOR OIL RANGE ORGANICS	300 U		300 U	300 U	300 U
TRPH		0.17 U			

Notes:

MG/L Milligrams per liter

TRPH Total recoverable petroleum hydrocarbons

UG/L Micrograms per liter

TABLE D-134: SITE 21 DISSOLVED GASES IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	CA03-01	S11-DGS-DP104	S11-DGS-DP104	S11-DGS-DP104	S11-DGS-DP101	S11-DGS-DP101	S11-DGS-DP101	S21-DGS-DP101
Sample Code	030-CAP-006	385-S11-113	385-S11-114	385-S11-115	385-S11-135	385-S11-139	385-S11-142	385-S21-101
Investigation	TPH	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	4/27/2000	8/28/2001	8/28/2001	8/28/2001	9/19/2001	9/19/2001	9/19/2001	8/29/2001
Sampling Depth (feet bgs)	0 - 10	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27	50 - 52	10 - 12
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
ETHANE		20	3 U	3 U	3 U	3 U	8.5	280
ETHENE		3 U	3 U	3 U	3 U	3 U	4	15 U
METHANE	0.5 U	5100 J	21	17	3420	19	34	10300

Location	S21-DGS-DP101	S21-DGS-DP101	S21-DGS-DP102	S21-DGS-DP102	S21-DGS-DP102	S21-DGS-DP103	S21-DGS-DP103	S21-DGS-DP103
Sample Code	385-S21-102	385-S21-103	385-S21-104	385-S21-105	385-S21-106	385-S21-107	385-S21-108	385-S21-109
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/27/2001	8/27/2001	8/27/2001
Sampling Depth (feet bgs)	25 - 27	50 - 52	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27	50 - 52
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
ETHANE	3 U	3 U	3 U	3 U	6.2	3 U	3 U	3 U
ETHENE	3 U	3 U	3 U	3 U	3	3 U	3 U	3 U
METHANE	37	13	5420	33	30	62	24	13

Location	S21-DGS-DP104	S21-DGS-DP104	S21-DGS-DP104	S21-DGS-DP105	S21-DGS-DP105	S21-DGS-DP105	S21-DGS-DP106	S21-DGS-DP106
Sample Code	385-S21-111	385-S21-115	385-S21-118	385-S21-119	385-S21-120	385-S21-121	385-S21-122	385-S21-123
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	9/19/2001	9/19/2001	9/19/2001	8/28/2001	8/28/2001	8/28/2001	8/30/2001	8/30/2001
Sampling Depth (feet bgs)	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27	50 - 52	10 -	25 -
Units	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Analyte								
ETHANE	14	2 J	2 J	141	3 U	3 U	3 U	3 U
ETHENE	3 U	3 U	3 U	6 U	3	3 U	3 U	3 U
METHANE	5500	65	13	10000	120	13	695	16

Notes:

UG/L Micrograms per liter

TABLE D-134: SITE 21 DISSOLVED GASES IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California
(Page 2 of 2)

Location	S21-DGS-DP106	WA-8	WA-8
Sample Code	385-S21-124	WA-8-A1104	WA-8-A1605
Investigation	DGS	GWM 2003	GWM 2003
Sampling Date	8/30/2001	6/20/2002	12/9/2002
Sampling Depth (feet bgs)	50 -	-	-
Units	UG/L	MG/L	UG/ML
Analyte			
ETHANE	4	0.01 U	0.01 U
ETHENE	3 U	0.01 U	0.01 U
METHANE	20	0.11	0.69

Notes:
MG/L Milligrams per liter
UG/L Micrograms per liter
UG/ML Micrograms per milliliter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	CA03-01	M11-06	M11-06	M11-06	M11-06	M07B-01	M07B-01	M07B-01	M07B-01
Sample Code	030-CAP-006	108-S11-002	108-S11-010	108-S11-014	108-S11-019	108-S21-001	108-S21-002	108-S21-003	108-S21-004
Investigation	TPH	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998	FO 1998
Sampling Date	4/27/2000	11/5/1997	2/6/1998	5/12/1998	8/7/1998	11/5/1997	2/13/1998	5/13/1998	8/7/1998
Sampling Depth (feet bgs)	0 - 10	-	-	-	-	-	-	-	-
Analyte									
ACIDITY (MG/L)									
BICARBONATE (MG/L*)	150	521	231	213	318	474	101	139	329
BROMIDE (MG/L)		0.79	0.26		0.61 J	1.8	0.1 U	0.1 U	0.66 J
CARBONATE (MG/L*)	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
CHLORIDE (MG/L)	12	166	48.2	67.8	108	433	8.1 J	11.5	122
COD (TOTAL) (MG/L)									
CONDUCTANCE (UMHOS/CM)									
DISSOLVED ORGANIC CARBON (MG/L)									
DISSOLVED SULFIDES (MG/L)									
FLUORIDE (MG/L)		1.1	0.42	0.72 J	0.5 U	1	0.45	0.38 J	0.5 U
HARDNESS (MG/L*)									
HYDROXIDE ALKALINITY (MG/L*)	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
NITRATE (MG/L)	0.16	0.1 U	1.3 J	0.38	0.5 U	0.1 U	0.2	0.33	0.5 U
NITRATE/NITRITE (AS N) (MG/L)									
NITRITE (MG/L)		0.2 U	0.13 J	1 U	0.5 U	0.5 U	0.1 U	0.1 U	0.5 U
ORTHOPHOSPHATE (MG/L)									
PH									
PHENOLPHTHALEIN ALKALINITY (MG/L)									
PHOSPHATE (MG/L)		11.9	1.2 J	1.9 J	2.7	3	0.54	0.32 J	2.3
SULFATE (MG/L)	73	3.3	43.8	23.1	18.8	52.5	8.8 J	10.1 J	22.7
SULFIDE (MG/L)		1 U	1 U	1 U	1.5 J	1 U	1 U	1 J	1 J
SUSPENDED ORGANIC CARBON (MG/L)									
TOTAL DISSOLVED SOLIDS (MG/L)		890	300	560	610	1200	190	420	600
TOTAL ALKALINITY (MG/L*)	150	521	231	213	318	474	101	139	329
TOTAL ORGANIC CARBON (MG/L)		8				3 UJ			

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	M07B-01	M07B-01	M07B-01	DHP-S07B-01	DHP-S07B-02	M11-06	M11-06
Sample Code	280-S7B11-051	280-S7B11-053	280-S7B11-054	280-S7B11-083	280-S7B11-084	280-S7B11-117	280-S7B11-154
Investigation	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994	FO 1994
Sampling Date	11/1/1994	6/16/1995	8/23/1995	8/4/1994	8/4/1994	11/29/1994	2/16/1995
Sampling Depth (feet bgs)	-	-	-	28.5 -	26.3 -	-	-
Analyte							
ACIDITY (MG/L)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
BICARBONATE (MG/L*)							
BROMIDE (MG/L)							
CARBONATE (MG/L*)							
CHLORIDE (MG/L)	477	112	240	27100	20700	94.8	111
COD (TOTAL) (MG/L)	17.9	7.7	31	602	1080	5 U	27 J
CONDUCTANCE (UMHOS/CM)	2490			58000	44900	1100	
DISSOLVED ORGANIC CARBON (MG/L)							
DISSOLVED SULFIDES (MG/L)				10 U			
FLUORIDE (MG/L)	0.64	0.23	0.83	0.1 UJ	0.1 UJ	0.67	0.14
HARDNESS (MG/L*)	295[a]	296	176	8400[a]	4730[a]	120[a]	210[a]
HYDROXIDE ALKALINITY (MG/L*)							
NITRATE (MG/L)			0.05 U				
NITRATE/NITRITE (AS N) (MG/L)	0.5 U	0.05 U	0.05 U	0.05 U	0.5 U	0.62	1 J
NITRITE (MG/L)			2.5 U				
ORTHOPHOSPHATE (MG/L)							
PH	8 J	8	7.8	6.9	7	7.9	7.8
PHENOLPHTHALEIN ALKALINITY (MG/L)							
PHOSPHATE (MG/L)							
SULFATE (MG/L)	57.2	27.3	41.2	4190	3250	22.9	30
SULFIDE (MG/L)							
SUSPENDED ORGANIC CARBON (MG/L)							
TOTAL DISSOLVED SOLIDS (MG/L)	1420	580	1020	44500	36300	700	710
TOTAL ALKALINITY (MG/L*)	493	411	401	440	497	451	396
TOTAL ORGANIC CARBON (MG/L)	4.5	3.6	2.3	2.3 J	3.8 J	11 J	3 J

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	M11-06	M11-06	S11-DGS-DP104	S11-DGS-DP104	S11-DGS-DP104	S11-DGS-DP101	S11-DGS-DP101
Sample Code	280-S7B11-155	280-S7B11-156	385-S11-113	385-S11-114	385-S11-115	385-S11-135	385-S11-139
Investigation	FO 1994	FO 1994	DGS	DGS	DGS	DGS	DGS
Sampling Date	6/19/1995	8/29/1995	8/28/2001	8/28/2001	8/28/2001	9/19/2001	9/19/2001
Sampling Depth (feet bgs)	-	-	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27
Analyte							
ACIDITY (MG/L)	10 U	10 U					
BICARBONATE (MG/L*)							
BROMIDE (MG/L)							
CARBONATE (MG/L*)							
CHLORIDE (MG/L)	83.6	216					
COD (TOTAL) (MG/L)	9.6	15.6					
CONDUCTANCE (UMHOS/CM)							
DISSOLVED ORGANIC CARBON (MG/L)			6.7	7.6	4.4	22.3	11.9
DISSOLVED SULFIDES (MG/L)							
FLUORIDE (MG/L)	0.16	0.84					
HARDNESS (MG/L*)	170	96					
HYDROXIDE ALKALINITY (MG/L*)							
NITRATE (MG/L)		0.05 U	8 U	8.4	8 U	2 U	4 U
NITRATE/NITRITE (AS N) (MG/L)	0.05 U	0.05 U					
NITRITE (MG/L)		1.2 U					
ORTHOPHOSPHATE (MG/L)			20 U	20 U	20 U	11.1	10 U
PH	7.9	7.8					
PHENOLPHTHALEIN ALKALINITY (MG/L)							
PHOSPHATE (MG/L)							
SULFATE (MG/L)	24.1	20.9	473	1780	3650	58	1510
SULFIDE (MG/L)							
SUSPENDED ORGANIC CARBON (MG/L)			0.79 J	1 U	1.2	1 U	1.4
TOTAL DISSOLVED SOLIDS (MG/L)	584	2470					
TOTAL ALKALINITY (MG/L*)	379	423					
TOTAL ORGANIC CARBON (MG/L)	3.6	5.1	7.5	7.7	5.6	22.4	13.3

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S11-DGS-DP101	S21-DGS-DP101	S21-DGS-DP101	S21-DGS-DP101	S21-DGS-DP102	S21-DGS-DP102	S21-DGS-DP102
Sample Code	385-S11-142	385-S21-101	385-S21-102	385-S21-103	385-S21-104	385-S21-105	385-S21-106
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	9/19/2001	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/29/2001	8/29/2001
Sampling Depth (feet bgs)	50 - 52	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27	50 - 52
Analyte							
ACIDITY (MG/L)							
BICARBONATE (MG/L*)							
BROMIDE (MG/L)							
CARBONATE (MG/L*)							
CHLORIDE (MG/L)							
COD (TOTAL) (MG/L)							
CONDUCTANCE (UMHOS/CM)							
DISSOLVED ORGANIC CARBON (MG/L)	7.3	13.6	5.4 UJ	4.3 UJ	7.6 UJ	6.3 UJ	3 UJ
DISSOLVED SULFIDES (MG/L)							
FLUORIDE (MG/L)							
HARDNESS (MG/L*)							
HYDROXIDE ALKALINITY (MG/L*)							
NITRATE (MG/L)	8 U	2 U	8 U	8 U	0.4 U	8 U	8 U
NITRATE/NITRITE (AS N) (MG/L)							
NITRITE (MG/L)							
ORTHOPHOSPHATE (MG/L)	20 U	10.9	20 U	20 U	7.9	20 U	20 U
PH							
PHENOLPHTHALEIN ALKALINITY (MG/L)							
PHOSPHATE (MG/L)							
SULFATE (MG/L)	3460	25 U	4400	2990	5 U	2980	2690
SULFIDE (MG/L)							
SUSPENDED ORGANIC CARBON (MG/L)	1 U	2.3	0.93 UJ	1 UJ	1.2 UJ	1 UJ	1.1 UJ
TOTAL DISSOLVED SOLIDS (MG/L)							
TOTAL ALKALINITY (MG/L*)							
TOTAL ORGANIC CARBON (MG/L)	7.4	15.9	6.3 UJ	4.4 UJ	8.8 UJ	6.6 UJ	4.1 UJ

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP103	S21-DGS-DP103	S21-DGS-DP103	S21-DGS-DP104	S21-DGS-DP104	S21-DGS-DP104	S21-DGS-DP105
Sample Code	385-S21-107	385-S21-108	385-S21-109	385-S21-111	385-S21-115	385-S21-118	385-S21-119
Investigation	DGS	DGS	DGS	DGS	DGS	DGS	DGS
Sampling Date	8/27/2001	8/27/2001	8/27/2001	9/19/2001	9/19/2001	9/19/2001	8/28/2001
Sampling Depth (feet bgs)	10 - 12	25 - 27	50 - 52	10 - 12	25 - 27	50 - 52	10 - 12
Analyte							
ACIDITY (MG/L)							
BICARBONATE (MG/L*)							
BROMIDE (MG/L)							
CARBONATE (MG/L*)							
CHLORIDE (MG/L)							
COD (TOTAL) (MG/L)							
CONDUCTANCE (UMHOS/CM)							
DISSOLVED ORGANIC CARBON (MG/L)	5 UJ	6.8 UJ	4.9 UJ	5	8.5	5.5	9.8
DISSOLVED SULFIDES (MG/L)							
FLUORIDE (MG/L)							
HARDNESS (MG/L*)							
HYDROXIDE ALKALINITY (MG/L*)							
NITRATE (MG/L)	4 U	4 U	8 U	0.04 U	2 U	8 U	0.4 U
NITRATE/NITRITE (AS N) (MG/L)							
NITRITE (MG/L)							
ORTHOPHOSPHATE (MG/L)	10 U	10 U	20 U	0.17	5 U	20 U	11.3
PH							
PHENOLPHTHALEIN ALKALINITY (MG/L)							
PHOSPHATE (MG/L)							
SULFATE (MG/L)	50 U	2510	4110	2.1	2320	2550	5 U
SULFIDE (MG/L)							
SUSPENDED ORGANIC CARBON (MG/L)	1 U	4.4	1 U	1 U	1 U	1 U	2.2
TOTAL DISSOLVED SOLIDS (MG/L)							
TOTAL ALKALINITY (MG/L*)							
TOTAL ORGANIC CARBON (MG/L)	5.5 UJ	11.2 UJ	5.5 UJ	5	8.7	5.7	12

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-DP105	S21-DGS-DP105	S21-DGS-DP106	S21-DGS-DP106	S21-DGS-DP106	M07B-01	M07B-01
Sample Code	385-S21-120	385-S21-121	385-S21-122	385-S21-123	385-S21-124	M07B-01	M07B-01-A1093
Investigation	DGS	DGS	DGS	DGS	DGS	PH 2B&3 1991	GWM 2003
Sampling Date	8/28/2001	8/28/2001	8/30/2001	8/30/2001	8/30/2001	8/21/1991	6/20/2002
Sampling Depth (feet bgs)	25 - 27	50 - 52	10 -	25 -	50 -	-	-
Analyte							
ACIDITY (MG/L)							
BICARBONATE (MG/L*)							
BROMIDE (MG/L)							
CARBONATE (MG/L*)							
CHLORIDE (MG/L)						152	110
COD (TOTAL) (MG/L)							
CONDUCTANCE (UMHOS/CM)							
DISSOLVED ORGANIC CARBON (MG/L)	14.5	6.1	11	8	6.3		
DISSOLVED SULFIDES (MG/L)							
FLUORIDE (MG/L)						0.74	
HARDNESS (MG/L*)						112[a]	
HYDROXIDE ALKALINITY (MG/L*)							
NITRATE (MG/L)	8 U	8 U	2 U	8 U	8 U		0.05 U
NITRATE/NITRITE (AS N) (MG/L)						0.063	
NITRITE (MG/L)							0.05 U
ORTHOPHOSPHATE (MG/L)	20 U	20 U	10.8	20 U	20 U		
PH							
PHENOLPHTHALEIN ALKALINITY (MG/L)							
PHOSPHATE (MG/L)							
SULFATE (MG/L)	3370	2530	288	3000	3810	44.79	27
SULFIDE (MG/L)							
SUSPENDED ORGANIC CARBON (MG/L)	1.1	8.4	1.8	1.6	1 U		
TOTAL DISSOLVED SOLIDS (MG/L)							
TOTAL ALKALINITY (MG/L*)						175[a]	
TOTAL ORGANIC CARBON (MG/L)	15.6	14.5	12.8	9.6	6.6	23.8	

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-135: SITE 21 GENERAL CHEMICALS IN GROUNDWATER

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	M07B-01	M11-06	M11-06	WA-8	WA-8	WA-8
Sample Code	M07B-01-A1594	M11-06-A1097	M11-06-A1598	WA-8	WA-8-A1104	WA-8-A1605
Investigation	GWM 2003	GWM 2003	GWM 2003	PH 2B&3 1991	GWM 2003	GWM 2003
Sampling Date	12/9/2002	6/20/2002	12/9/2002	9/4/1991	6/20/2002	12/9/2002
Sampling Depth (feet bgs)	-	-	-	-	-	-
Analyte						
ACIDITY (MG/L)						
BICARBONATE (MG/L*)				233[a]	800	970
BROMIDE (MG/L)						
CARBONATE (MG/L*)				5 U[a]	1 U	1 U
CHLORIDE (MG/L)	210	170	240	1332	590	560
COD (TOTAL) (MG/L)						
CONDUCTANCE (UMHOS/CM)						
DISSOLVED ORGANIC CARBON (MG/L)						
DISSOLVED SULFIDES (MG/L)						
FLUORIDE (MG/L)				0.75		
HARDNESS (MG/L*)				460[a]		
HYDROXIDE ALKALINITY (MG/L*)				5 U[a]	1 U	1 U
NITRATE (MG/L)	0.05 U	0.05 U	0.05 U		0.05 U	0.03 U
NITRATE/NITRITE (AS N) (MG/L)				0.061		
NITRITE (MG/L)	0.05 U	0.05 U	0.05 U		0.05 U	0.1 U
ORTHOPHOSPHATE (MG/L)						
PH						
PHENOLPHTHALEIN ALKALINITY (MG/L)				5 U		
PHOSPHATE (MG/L)						
SULFATE (MG/L)	40	23	22	80.12	47	16
SULFIDE (MG/L)					0.04 U	0.04 U
SUSPENDED ORGANIC CARBON (MG/L)						
TOTAL DISSOLVED SOLIDS (MG/L)						
TOTAL ALKALINITY (MG/L*)				233[a]	800	970
TOTAL ORGANIC CARBON (MG/L)				90.5 J		

Notes:

*	Except where indicated
[a]	MG/L-CACO3
MG/L	Milligrams per liter
MG/L-CACO3	Milligrams per liter of calcium carbonate
UMHOS/CM	Micromhos per centimeter

TABLE D-136: SITE 21 LANDFILL GASES IN AIR

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California
(Page 1 of 1)

Location	S21-DGS-SG03	S21-DGS-SG03	S21-DGS-SG06	S21-DGS-SG06
Sample Code	385-S21-038	385-S21-039	385-S21-043	385-S21-044
Investigation	DGS	DGS	DGS	DGS
Sampling Date	7/30/2001	7/30/2001	7/30/2001	7/30/2001
Sampling Depth (feet bgs)	.5 - 1.5	4 -	1.5 -	3 -
Units	PPMV	PPMV	PPMV	PPMV
Analyte				
BUTANE	1 U	1 U	1 U	1 U
ETHANE	1 U	1 U	1 U	1 U
ISOBUTANE	1 U	1 U	1 U	1 U
ISOPENTANE	1 U	1 U	1 U	1 U
NON METHANE ORGANIC COMPOUNDS	10 U	10 U	10 U	10 U
PENTANE	1 U	1 U	1 U	1 U
PROPANE	1 U	1 U	1 U	1 U

Location	S21-DGS-SG03	S21-DGS-SG03	S21-DGS-SG06	S21-DGS-SG06
Sample Code	385-S21-038	385-S21-039	385-S21-043	385-S21-044
Investigation	DGS	DGS	DGS	DGS
Sampling Date	7/30/2001	7/30/2001	7/30/2001	7/30/2001
Sampling Depth (feet bgs)	.5 - 1.5	4 -	1.5 -	3 -
Units	%	%	%	%
Analyte				
CARBON DIOXIDE	0.526	0.325	0.619	0.779
CARBON MONOXIDE	0.001 U	0.001 U	0.001 U	0.001 U
HYDROGEN	0.02 U	0.02 U	0.02 U	0.03 U
METHANE	0.001 U	0.001 U	0.001 U	0.001 U
NITROGEN	77.89	78.48	77.64	77.61
OXYGEN	21.59	21.2	21.74	21.61

Notes:
PPMV Parts per million by volume

TABLE D-137: SITE 21 VOLATILE ORGANIC COMPOUNDS IN AIR

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	S21-DGS-SG03	S21-DGS-SG03	S21-DGS-SG06	S21-DGS-SG06
Sample Code	385-S21-038	385-S21-039	385-S21-043	385-S21-044
Investigation	DGS	DGS	DGS	DGS
Sampling Date	7/30/2001	7/30/2001	7/30/2001	7/30/2001
Sampling Depth (feet bgs)	.5 - 1.5	4 -	1.5 -	3 -
Units	UG/M3	UG/M3	UG/M3	UG/M3
Analyte				
1,1,1-TRICHLOROETHANE	67.61 U	133.85 J	17.18 U	70.42 U
1,1,2,2-TETRACHLOROETHANE	85.06 U	86.48 UJ	21.62 U	88.6 U
1,1,2-TRICHLOROETHANE	67.61 U	68.73 UJ	17.18 U	70.42 U
1,1-DICHLOROETHANE	50.15 U	50.98 UJ	12.75 U	52.24 U
1,1-DICHLOROETHENE	49.13 U	49.94 UJ	12.49 U	51.17 U
1,2-DICHLOROBENZENE	74.49 U	75.73 UJ	18.93 U	77.6 U
1,2-DICHLOROETHANE	50.15 U	50.98 UJ	12.75 U	52.24 U
1,3-DICHLOROBENZENE	74.49 U	75.73 UJ	18.93 U	77.6 U
1,4-DICHLOROBENZENE	74.49 U	75.73 UJ	18.93 U	77.6 U
BENZENE	78.28	62.52 J	41.36	90.95
CHLOROETHANE	32.7 U	33.24 UJ	8.31 U	34.06 U
CHLOROMETHANE	25.59 U	26.01 UJ	6.5 U	26.65 U
CIS-1,2-DICHLOROETHENE	49.13 U	49.94 UJ	12.49 U	51.17 U
ETHYLBENZENE	198.48	169.77 J	243.55	235.46
M-XYLENE	936.6	811.06 J	1025.23	937.33
NAPHTHALENE	649.51 UJ	660.34 UJ	165.08 UJ	676.57 UJ
O-XYLENE	214.8	223.03 J	229.66	236.54
TETRACHLOROETHENE	84.54 U	85.95 UJ	31.55	88.06 U
TOLUENE	1456.82	1255.2 J	564.48	918.73
TRANS-1,2-DICHLOROETHENE	49.13 UJ	49.94 UJ	12.49 UJ	51.17 UJ
TRICHLOROETHENE	66.58 U	67.69 UJ	93.15	82.13
VINYL CHLORIDE	31.67 U	32.2 UJ	8.05 U	32.99 U

Notes:

UG/M3 Micrograms per cubic meter

TABLE D-138: SITE 21 SEMIVOLATILE ORGANIC COMPOUNDS IN SEDIMENT

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	NPS-S03-02	NPS-S11-02	NPS-S7B-01
Sample Code	280-S03-038	280-S7B11-048	280-S7B11-050
Investigation	FO 1994	FO 1994	FO 1994
Sampling Date	7/20/1994	8/24/1994	7/18/1994
Sampling Depth (feet bgs)	-	0 -	-
Units	UG/KG	UG/KG	UG/KG
Analyte			
1,2,4-TRICHLOROBENZENE	2000 U	2100 U	1400 U
1,2-DICHLOROBENZENE	2000 U	2100 U	1400 U
1,3-DICHLOROBENZENE	2000 U	2100 U	1400 U
1,4-DICHLOROBENZENE	2000 U	2100 U	1400 U
2,2'-OXYBIS(1-CHLOROPROPANE)	2000 U	2100 U	1400 U
2,4,5-TRICHLOROPHENOL	4900 U	5100 U	3300 U
2,4,6-TRICHLOROPHENOL	2000 U	2100 U	1400 U
2,4-DICHLOROPHENOL	2000 U	2100 U	1400 U
2,4-DIMETHYLPHENOL	2000 U	2100 U	1400 U
2,4-DINITROPHENOL	4900 U	5100 U	3300 U
2,4-DINITROTOLUENE	2000 U	2100 U	1400 U
2,6-DINITROTOLUENE	2000 U	2100 U	1400 U
2-CHLORONAPHTHALENE	2000 U	2100 U	1400 U
2-CHLOROPHENOL	2000 U	2100 U	1400 U
2-METHYLNAPHTHALENE	2000 U	2100 U	1400 U
2-METHYLPHENOL	2000 U	2100 U	1400 U
2-NITROANILINE	4900 U	5100 U	3300 U
2-NITROPHENOL	2000 U	2100 U	1400 U
3,3'-DICHLOROBENZIDINE	2000 U	2100 U	1400 U
3-NITROANILINE	4900 U	5100 U	3300 U
4,6-DINITRO-2-METHYLPHENOL	4900 U	5100 U	3300 U
4-BROMOPHENYL-PHENYLETHER	2000 U	2100 U	1400 U
4-CHLORO-3-METHYLPHENOL	2000 U	2100 U	1400 U
4-CHLOROANILINE	2000 U	2100 U	1400 U
4-CHLOROPHENYL-PHENYLETHER	2000 U	2100 U	1400 U
4-METHYLPHENOL	2000 U	2100 U	1400 U
4-NITROANILINE	4900 U	5100 U	3300 U
4-NITROPHENOL	4900 U	5100 U	3300 U
ACENAPHTHENE	2000 U	2100 U	68 J
ACENAPHTHYLENE	100 J	2100 U	1400 U
ANTHRACENE	300 J	2100 U	89 J
BENZO(A)ANTHRACENE	2800	280 J	400 J
BENZO(A)PYRENE	2600	170 J	330 J
BENZO(B)FLUORANTHENE	4600	280 J	640 J
BENZO(G,H,I)PERYLENE	820 J	130 J	310 J
BENZO(K)FLUORANTHENE	1900 J	160 J	260 J
BIS(2-CHLOROETHOXY)METHANE	2000 U	2100 U	1400 U
BIS(2-CHLOROETHYL)ETHER	2000 U	2100 U	1400 U
BIS(2-ETHYLHEXYL)PHTHALATE	6500 UJ	2100 UJ	7000 UJ
BUTYLBENZYLPHTHALATE	2000 UJ	2100 U	1400 UJ
CARBAZOLE	2000 U	2100 U	1400 U
CHRYSENE	2900	310 J	430 J
DIBENZO(A,H)ANTHRACENE	2000 U	2100 U	1400 U
DIBENZOFURAN	2000 U	2100 U	1400 U
DIETHYLPHTHALATE	2000 U	2100 U	1400 U
DIMETHYLPHTHALATE	2000 U	2100 U	1400 U
DI-N-BUTYLPHTHALATE	2000 UJ	2100 U	1400 UJ
DI-N-OCTYLPHTHALATE	2000 U	2100 U	7000 UJ
FLUORANTHENE	2500	340 J	690 J
FLUORENE	120 J	2100 U	1400 U
HEXACHLOROBENZENE	2000 U	2100 U	1400 U
HEXACHLOROBUTADIENE	2000 U	2100 U	1400 U

TABLE D-138: SITE 21 SEMIVOLATILE ORGANIC COMPOUNDS IN SEDIMENT

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Sample Code	280-S03-038	280-S7B11-048	280-S7B11-050
Investigation	FO 1994	FO 1994	FO 1994
Sampling Date	7/20/1994	8/24/1994	7/18/1994
Sampling Depth (feet bgs)	-	0 -	-
Units	UG/KG	UG/KG	UG/KG
Analyte			
HEXACHLOROCYCLOPENTADIENE	2000 U	2100 U	1400 U
HEXACHLOROETHANE	2000 U	2100 U	1400 U
INDENO(1,2,3-CD)PYRENE	1100 J	150 J	280 J
ISOPHORONE	2000 U	2100 U	1400 U
NAPHTHALENE	2000 U	2100 U	1400 U
NITROBENZENE	2000 U	2100 U	1400 U
N-NITROSO-DI-N-PROPYLAMINE	2000 U	2100 U	1400 U
N-NITROSODIPHENYLAMINE	2000 U	2100 U	1400 U
PENTACHLOROPHENOL	4900 UJ	5100 UJ	3300 UJ
PHENANTHRENE	750 J	110 J	350 J
PHENOL	2000 U	2100 U	1400 U
PYRENE	2200	350 J	650 J

Notes:

UG/KG Micrograms per kilogram

TABLE D-139: SITE 21 VOLATILE ORGANIC COMPOUNDS IN SEDIMENT

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	NPS-S03-02	NPS-S11-02	NPS-S7B-01
Sample Code	280-S03-038	280-S7B11-048	280-S7B11-050
Investigation	FO 1994	FO 1994	FO 1994
Sampling Date	7/20/1994	8/24/1994	7/18/1994
Sampling Depth (feet bgs)	-	0 -	-
Units	UG/KG	UG/KG	UG/KG
Analyte			
1,1,1-TRICHLOROETHANE	12 U	11 U	14 U
1,1,2,2-TETRACHLOROETHANE	12 U	11 U	14 U
1,1,2-TRICHLOROETHANE	12 U	11 U	14 U
1,1-DICHLOROETHANE	12 U	11 U	14 U
1,1-DICHLOROETHENE	12 U	11 U	14 U
1,2-DICHLOROETHANE	12 U	11 U	14 U
1,2-DICHLOROETHENE (TOTAL)	12 U	11 U	3 J
1,2-DICHLOROPROPANE	12 U	11 U	14 U
2-BUTANONE	12 UJ	11 U	14 UJ
2-HEXANONE	12 U	11 U	14 U
4-METHYL-2-PENTANONE	12 U	11 U	14 U
ACETONE	12 UJ	14 UJ	70 UJ
BENZENE	12 U	11 U	14 U
BROMODICHLOROMETHANE	12 U	11 U	14 U
BROMOFORM	12 U	11 U	14 U
BROMOMETHANE	12 U	11 U	14 U
CARBON DISULFIDE	12 UJ	11 U	14 U
CARBON TETRACHLORIDE	12 U	11 U	14 U
CHLOROBENZENE	12 U	11 U	14 U
CHLOROETHANE	12 U	11 U	14 U
CHLOROFORM	12 U	11 U	14 U
CHLOROMETHANE	12 UJ	11 U	14 UJ
CIS-1,3-DICHLOROPROPENE	12 U	11 U	14 U
DIBROMOCHLOROMETHANE	12 U	11 U	14 U
ETHYLBENZENE	12 U	11 U	14 U
ETHYLENE DIBROMIDE	12 U		14 U
LEAD, ORGANIC			
METHYLENE CHLORIDE	12 U	11 U	14 UJ
STYRENE	12 U	11 U	14 U
TETRACHLOROETHENE	12 U	11 U	14 U
TOLUENE	12 U	11 U	2 J
TRANS-1,3-DICHLOROPROPENE	12 U	11 U	14 U
TRICHLOROETHENE	12 U	11 U	14 U
VINYL CHLORIDE	12 U	11 U	14 U
XYLENE (TOTAL)	12 U	11 U	14 U

Notes:
UG/KG Micrograms per kilogram

TABLE D-140: SITE 21 TOTAL PETROLEUM HYDROCARBONS IN SEDIMENT

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	NPS-S03-02	NPS-S11-02	NPS-S7B-01
Sample Code	280-S03-038	280-S7B11-048	280-S7B11-050
Investigation	FO 1994	FO 1994	FO 1994
Sampling Date	7/20/1994	8/24/1994	7/18/1994
Sampling Depth (feet bgs)	-	0 -	-
Units	MG/KG	MG/KG	MG/KG
Analyte			
DIESEL RANGE ORGANICS	120 U	63 U	140 U
GASOLINE RANGE ORGANICS	0.61 U	0.63 U	0.68 U
JP5 RANGE ORGANICS	120 U	63 U	140 U
MOTOR OIL RANGE ORGANICS	2480 J	220 J	1940 J

Notes:

MG/KG Milligrams per kilogram

TABLE D-141: SITE 21 GENERAL CHEMICALS IN SEDIMENT

Remedial Investigation Report for OU-2B, Alameda Point, Alameda, California

Location	NPS-S03-02	NPS-S11-02	NPS-S7B-01
Sample Code	280-S03-038	280-S7B11-048	280-S7B11-050
Investigation	FO 1994	FO 1994	FO 1994
Sampling Date	7/20/1994	8/24/1994	7/18/1994
Sampling Depth (feet bgs)	-	0 -	-
Units			
Analyte			
PERCENT MOISTURE	17.8	21.5	27.3
PH	7.6	8.1	8

APPENDIX E
STATISTICAL METHODS FOR ANALYSIS OF OU-2B SOIL AND GROUNDWATER AT ALAMEDA POINT

TABLE OF CONTENTS

Attachments

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

CDF	Cumulative distribution function
DF	Detection frequency
DON	Department of the Navy
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
GOF	Goodness-of-fit
H_0	Null hypothesis
H_A	Alternative hypothesis
HHRA	Human health risk assessment
MVUE	Minimum variance unbiased estimator
n	Sample size
Navy	U.S. Department of the Navy
ND	Nondetect
OU	Operable Unit
RAGS	Risk Assessment Guidance for Superfund
s	Standard deviation
SE	Standard error
UCL	One-sided upper confidence limit of the mean
WRS	Wilcoxon rank sum test
WRS(G)	Gehan-Wilcoxon rank sum test

Cumulative Distribution Function	The cumulative distribution function (CDF) of a set of numerical data is, for each real value of x, the fraction of observations that are less than or equal to x. Stated more formally, the CDF gives the probability that a random variable X is less than or equal to x, for every value of x. This is expressed in mathematical notation as: $F(x)= Prob(X \leq x)$ for $-\infty < x < \infty$. For continuous random variables, the CDF is the integral of its probability density function, and a plot of the cumulative distribution function resembles an uneven set of stairs. The width of the stairs is the spacing between adjacent data; the height of the stairs depends on how many data have exactly the same value.
Exposure Point Concentration	An estimate of the average concentration of a contaminant within a specified area (the exposure unit). Also referred to as the concentration term. Because of the inherent uncertainty in estimating the true average concentration at a site, an upper confidence limit (UCL) of the mean is used as the exposure point concentration in risk assessments.
Quantile	Quantiles are a set of "cut points" that divide rank-ordered data into groups of equal numbers of observations. An individual quantile defines a cut point below which a certain number or percentage of the data are found (for example, 90 percent of the measurements in a set lie below the 90^{th} quantile).
Standard Deviation	A measure of the spread or dispersion of a set of data. The sample standard deviation is an estimator of the population standard deviation based on a random sample from the population.
Type I Error	The probability that a given H_0 will be incorrectly rejected when it is true. The Type I error is represented by the symbol, alpha (α).
Type II Error	The probability of correctly rejecting h_0 when it is false. The type II error is represented by the symbol, beta (β). One minus beta ($1-\beta$) is referred to as the power of a test.
UCL	The one-sided UCL of the mean. This is an upper bound for a random interval, and indicates that there is a fixed probability that the true population mean is no larger than this value. Following current U.S. Environmental Protection Agency guidance, the UCL can be either 95, 97.5, or 99 percent.

1.0 INTRODUCTION

Statistical analysis of soil and groundwater data for Operable Unit (OU) 2B at Alameda Point, which is comprised of Comprehensive Environmental Response, Compensation, and Liability Act Sites 3, 4, 11 and 21, was conducted to support the remedial investigation human health risk assessment (HHRA) and nature and extent evaluations and had two objectives:

(1) Provide tables of descriptive statistics, including exposure point concentrations (EPC), for all chemicals detected in at least one sample, and

(2) Compare concentrations of metals in site soil and groundwater samples to ambient concentrations established for Alameda Point using two-population statistical tests.

Details of the HHRA and presentation of the statistical results for the EPC calculations are provided in Appendix F. All calculations described in this appendix follow U.S. Environmental Protection Agency (EPA) and U.S. Department of the Navy (Navy) guidance (EPA 2000, 2002, 2004; Navy 1998, 1999, 2002). Section 2.0 describes the approach used for calculating descriptive statistics and EPCs, and Section 3.0 describes the approach for screening ambient metals and presents summary tables of the statistical results. References are provided in Section 4.0.

2.0 CALCULATION OF DESCRIPTIVE STATISTICS AND EXPOSURE POINT CONCENTRATIONS

The initial selection of an approach for calculating descriptive statistics and EPCs is based on the sample size and detection frequency (DF), as shown in Figure E-1. Calculations are only performed for chemicals detected in at least one sample. For sample sizes less than 3, the EPC defaults to the maximum detected concentration. Tabular formats for presenting statistical results follow the EPA's "Risk Assessment Guidelines for Superfund" (RAGS) guidance instructions for reporting descriptive statistics and EPCs (EPA 2001). Distribution, statistic, and rationale codes for the RAGS Table 3 formats have been modified to be compatible with recently promulgated guidance (EPA 2004) and the methods described in this appendix.

For chemicals with at least 5 measurements and DFs of at least 50 percent, formal goodness-of-fit (GOF) tests and graphical displays of the data are used to determine the underlying distribution, as shown in Figure E-2 and described in Section 2.1. Sections 2.2 and 2.3, respectively, describe the approaches used for performing calculations in cases where (1) the DF is greater than or equal to 85 percent, and (2) the DF is less than 85 percent. For cases where the DF is at least 85 percent, calculation of EPCs follows the same protocols recommended in EPA's ProUCL Version 3 software package (EPA 2004).

2.1 DISTRIBUTION TESTING

Both graphical methods and statistical GOF tests were used to assign a best-fit distribution for chemicals with sample sizes of at least 5 and DFs of at least 50 percent. Graphical methods included the preparation of quantile probability plots, outlier box plots, and frequency histograms for three potential fits: normal, lognormal, and gamma. Formal statistical tests were conducted using two well-established GOF tests: Shapiro-Wilk W test (normal, lognormal distributions), and the Cramer-von Mises W test (gamma distributions). The statistical GOF tests are described below. An example showing the graphical methods used as well as presentation of the results of the formal GOF tests, is provided in Figure E-2.

The Shapiro-Wilk W test is one of the most powerful GOF tests for determining if a set of measurements follows either a normal or a lognormal distribution. The W test relies on computing a correlation between the quantiles of the standard normal distribution and the ordered values of the observed data. When the W statistic is close to 1.0, the observed data will follow an essentially straight line when displayed using a normal probability plot. The following null (H_0) and alternative (H_A) hypotheses were tested using the W test:

H_0: The data follow a normal distribution.

H_A: The data do not follow a normal distribution.

Tests are conducted sequentially on data in original and natural-log transformed units. A Type I error rate (α) of 0.05 (equivalent to 5 percent) was used to interpret the significance of each test. A Type I error rate of 0.05 means that there is a 5 percent chance that the null hypothesis will be rejected when it is true (that is, the data are normally distributed), leading to the false conclusion that the underlying distribution is not normal. When the test is conducted using log-transformed data, failure to reject H_0 leads to the conclusion that the data follow a lognormal distribution (rejection of H_0 indicates that the data are not lognormally distributed).

The Cramer-von Mises W test belongs to the quadratic class of empirical distribution function statistics and is based on evaluating the squared difference between the EDF and the proposed cumulative distribution function (CDF). The test statistic evaluated for the Cramer-von Mises test is the W^2. When the probability of calculating a W^2 greater than that shown for the observed data is less than some nominal probability, then the H_0 that the data follow a gamma distribution is rejected. If the test fails to reject H_0, then it is concluded that the data follow a gamma distribution.

Final determination of the best-fit distribution was made using the results of the statistical GOF tests as well as through examination of probability plots, outlier box plots, and frequency histograms. Best professional judgment is required to make the final determination because the power (defined as $1-\beta$, where β is the Type II error) of the GOF tests is strongly affected by sample size as well as the presence of outliers and censored measurements. In cases where GOF testing determines that a chemical follows more than one distribution, additional decision criteria are applied. In cases where chemicals follow a normal distribution, a normal distribution is assigned

irrespective of whether the data can also be fit to a lognormal and/or gamma distribution. If the data can be fit to both a lognormal and gamma distribution, then the best-fit distribution was selected based on further examination of the quantile probability plots for each distribution. In this case, two criteria were evaluated in selecting the best-fit distribution: the number of measurements that depart from the linear fit of the observed data to the theoretical quantiles, and the magnitude of departure of each measurement from the linear fit. The distribution with the fewest number and smallest magnitude of departure from the fitted line in the quantile probability plots was selected as the best-fit distribution for each chemical.

2.2 CALCULATION OF EXPOSURE POINT CONCENTRATIONS WHEN DETECTION FREQUENCIES ARE AT LEAST 85 PERCENT

The selection of the optimal method for estimating the EPC when at least 85 percent of the data were detected followed recommendations provided in EPA's ProUCL software package (EPA 2004), as shown in Figure E-3. The ProUCL package is only suitable when no more than 15 percent of the data are left-censored (nondetect or ND). Censored data evaluated using the ProUCL approach were replaced by surrogate values calculated using one-half the reported result.

Recommendations in ProUCL are based on the results of simulation experiments conducted to determine the relative coverage probabilities (that is, likelihood that the true mean is bounded by the upper confidence limit [UCL] on the mean) for different mathematical models used to calculate a one-sided UCL of the mean (Singh, Singh, and Engelhardt 1997; Singh, Singh, and Iaci 2002; Singh and Nocerino 2002). In this approach, each method is applied to a series of synthetic data sets drawn from different known theoretical distributions or mixtures of distributions. Both the skewness of the underlying distributions for the parent data sets and the size of the samples drawn from each data set are manipulated as part of the experimental design. Selection of an optimal method for calculating a UCL is based on the overall performance of each analytical method over the range of conditions evaluated. ProUCL implements a series of decision rules to select an optimal method based on three sample properties: (1) best-fit distribution, (2) relative degree of skewness, and (3) relative sample size.

The ProUCL approach is heavily dependent on estimating the underlying distribution of a sample. An important update incorporated in ProUCL Version 3.0 is the inclusion of models to calculate a UCL based on the gamma distribution. Singh, Singh, and Engelhardt (1997) reported that UCLs calculated for data following a lognormal distribution using Land's method (EPA 1992; Gilbert 1987; Land 1975) are often inappropriately high for use in risk assessments. Other investigators have also studied alternative methods for calculating the UCL when data are skewed (Chen 1995; Schultz and Griffin 1999). Singh, Singh, and Iaci (2002) and EPA (2004) suggest that UCL calculations based on a gamma model are more appropriate for skewed distributions that can be fit to either a gamma or lognormal model.

The detailed decision rules used for selecting a method are provided in Tables E-1 through E-3. Following a chemical-by-chemical evaluation of the sample size, underlying distribution, and

degree of skewness, a UCL was calculated based on one of the parametric or nonparametric methods listed below (all methods from EPA [2004]).

Parametric Methods	Nonparametric Methods
Student's t UCL	Nonparametric Chebyshev UCL
Approximate gamma UCL	Bootstrap t UCL
Adjusted gamma UCL	Hall's bootstrap UCL
Land's H-UCL	
MVUE Chebyshev UCL	

The EPC calculated using the minimum variance unbiased estimator (MVUE) Chebyshev or nonparametric Chebyshev method can be based on either a one-sided 95, 97.5, or 99 percent UCL. EPCs calculated using Student's t statistic or bootstrap approaches are based on a one-side 95 percent UCL. For chemicals with fewer than five samples, the maximum detected concentration is used as the EPC. The maximum detected concentration is also the default EPC in cases where a particular estimate calculated using one of the methods described above exceeds the maximum detected concentration.

The following equations were used to calculate the mean, standard deviation (s), standard error (SE), and UCL for the methods listed above. All terms in the equations below are defined on first usage only. In cases where the definition of a term is equation-specific, separate definitions are provided under each equation.

Equation E-1: Arithmetic Mean

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i, \text{ where}$$

$\bar{x}$ is the sample arithmetic mean
n is the sample size
x_i is the i^{th} measurement in the sample

Equation E-2: Sample Standard Deviation

$$s = \frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2, \text{ where}$$

s is the sample standard deviation

Equation E-3: MVUE of the Mean

$$\hat{\mu} = [e(\bar{y})]\psi_n\left(\frac{s_y^2}{2}\right), \text{ where}$$

$\hat{\mu}$ is the MVUE for the mean of a lognormal distribution
$\bar{y}$ is the mean of the natural logarithms of the sample data

e is Euler's constant

s_y^2 is the variance of the natural logarithms of the sample data

$\psi_n(t)$ is an infinite series, calculated as

$$\psi_n(t) = 1 + \frac{(n-1)t}{n} + \frac{(n-1)^3 t^2}{2!\,n^2(n+1)} + \frac{(n-1)^5 t^3}{3!\,n^3(n+1)(n+3)} + \frac{(n-1)^7 t^4}{4!\,n^4(n+1)(n+3)(n+5)} + \cdots$$

where: $t = \frac{s_y^2}{2}$

Equation E-4 : MVUE of the Variance of the Mean

$$s^2(\hat{\mu}) = e(2\bar{y})\left\{\left[\psi_n\left(\frac{s_y^2}{2}\right)\right]^2 - \psi_n\left[\frac{s_y^2(n-2)}{n-1}\right]\right\}, \text{ where}$$

$s^2(\hat{\mu})$ is the MVUE variance of the mean (that is, the standard error) of a lognormal distribution

Equation E-5: UCL Calculated Using Student's *t*-Statistic

$$UCL_{1-\alpha} = \bar{x} + t_{1-\alpha,n-1}\frac{s}{\sqrt{n}}, \text{ where}$$

$UCL_{1-\alpha}$ is the 1-α UCL calculated using Student's t-statistic

α is the Type I error rate

$t_{1-\alpha,n-1}$ is the 1-α quantile of Student's t distribution with n-1 degree of freedom

Equation E-6: UCL Calculated Using the H Statistic (Land's Method)

$$UCL_{1-\alpha} = e\left(\bar{y} + 0.5s_y^2 + \frac{s_y H_{1-\alpha}}{\sqrt{n-1}}\right), \text{ where}$$

$UCL_{1-\alpha}$ is the 1-α UCL calculated using Land's H statistic

s_y is the standard deviation of the natural logarithms of the sample data

H Land's H statistic, obtained from published tables

Equation E-7: UCL Calculated Using the Nonparametric Chebyshev Method

$$UCL_{1-\alpha} = \bar{x} + \sqrt{\frac{1}{\alpha} - 1}\left(\frac{s}{\sqrt{n}}\right), \text{ where}$$

$UCL_{1-\alpha}$ is the 1-α UCL calculated using the nonparametric Chebyshev method

Equation E-8: UCL Calculated Using the MVUE Chebyshev Method

$$UCL_{1-\alpha} = \bar{y} + \sqrt{\left(\frac{1}{\alpha} - 1\right) s^2(\hat{\mu})}, \text{ where}$$

$UCL_{1-\alpha}$ is the 1-α UCL calculated using the MVUE Chebyshev method

Equation E-9: UCL Calculated Using the Approximate Gamma Method

$$UCL_{1-\alpha} = \frac{2n\hat{k}^*\bar{x}}{\chi^2_{2n\hat{k}^*}(\alpha)}, \text{ where}$$

$UCL_{1-\alpha}$ is the 1-α UCL calculated using the approximate gamma method

$\hat{k}^*$ is the bias-corrected maximum likelihood estimate (MLE) of the shape parameter for a gamma distribution, calculated as

$$\hat{k}^* = \frac{(n-3)\hat{k}}{n} + \frac{2}{n}, \text{ where } \hat{k} \text{ is the MLE of the shape parameter}$$

$\chi^2_{2n\hat{k}^*}$ is the quantile of the Chi-square distribution with $2n\hat{k}^*$ degrees of freedom

Equation E-10: UCL Calculated Using the Adjusted Gamma Method

$$UCL_{1-\alpha} = \frac{2n\hat{k}^*\bar{x}}{\chi^2_{2n\hat{k}^*}(\beta)}, \text{ where}$$

$UCL_{1-\alpha}$ is the 1-α UCL calculated using the adjusted gamma method

β is the adjusted value of α, the Type I error rate, from the table provided in Grice and Bain (1980) and reproduced in EPA (2004)

2.3 CALCULATION OF EXPOSURE POINT CONCENTRATIONS WHEN DETECTION FREQUENCIES ARE LESS THAN 85 PERCENT

With increasing frequencies of left-censored data, it becomes less likely that standard mathematical models used to calculate point estimates of a UCL of the mean will perform satisfactorily. In these cases, a "bounding" approach was used to estimate a plausible upper limit for the UCL following EPA (2002). This approach treats each censored datum as a random, uniform variable that can assume any value between zero and its respective reporting limit (Figure E-4). Monte Carlo simulation is used to develop a distribution of the range of possible estimates for a UCL based on the selection of a particular mathematical form for the UCL. Random surrogate values between zero and the reporting limit are used for individual censored measurements in each calculation (default is 2,000 calculations) of the UCL; therefore, the resulting distribution reflects a range of possible values that could be calculated for the UCL. Since substitution of random surrogate values is made for each censored

measurement, this technique reflects the uncertainty contributed by varying levels of censored data, and is appropriate for samples with either single or multiple censoring limits.

One of three base equations were used to calculate a UCL in the bounding simulations, depending on a best-fit estimate of the underlying distribution of the data (Figure E-4). For distributions confirmed or assumed to be normally distributed, Student's *t*-statistic was used (Equation E-5). For skewed distributions that could be modeled as a lognormal or approximately lognormal, the MVUE Chebyshev method (Equation E-8) was used. The nonparametric Chebyshev method (Equation E-7) was used in cases where the data could not be fit to either a normal or lognormal distribution. The nonparametric Chebyshev equation was also used as the default in cases where detection frequencies were less than 50 percent and no attempt was made to determine the distribution of the data. The nonparametric Chebyshev method has been shown to have excellent properties (that is, good coverage and less likely to generate results that exceed the maximum detected measurement) under a range of conditions using actual data and in simulation experiments (EPA 2004).

If the range (difference between the minimum and maximum estimates) for the distribution of all potential values of the UCL is small, then this indicates that censored measurements contributed little to the uncertainty of the estimates. In practice, this is often not the case, and it is necessary to select a concentration to be used as a "plausible upper bound" for the UCL. For Alameda, the 95th percentile of the distribution of 2,000 modeled estimates of the UCL was used as the upper-bound concentration. The maximum concentration is not appropriate because it represents the highest concentration that could theoretically be calculated (or nearly so based on 2,000 calculations) from the sample data and, therefore, represents a "worst-case" concentration rather than a plausible upper bound. The median value of the distribution of the arithmetic mean (calculated using the same stochastic modeling approach) was reported using the RAGS Table 2 format.

3.0 BACKGROUND SCREENING OF METALS

Two-population statistical tests were used to compare metal concentrations in site data to background concentrations determined for Alameda soil (pink and blue data sets) and groundwater, as shown in Figure E-5. Details of the construction of the soil and groundwater data sets are provided in Attachments A and B. Summary tables for the soil and groundwater background data sets are provided in Tables E-4 through E-6. Results of the statistical comparison of soil samples for Sites 3, 4, 11, and 21 with the background data sets are provided in Tables E-7 through E-10. The "blue" background data set was used for Site 4, and the "pink" background data set was used for Sites 3, 11, and 21. Results of the statistical comparison of the sitewide groundwater data with the ambient groundwater data set for Alameda are presented in Table E-11.

As shown on Figure E-5 and described below, a tiered approach employing one or more statistical methods was used to conduct two-population tests. The first tier in this approach compares the median concentrations between the site and background populations using either the Wilcoxon rank sum (WRS) test, Gehan's modification to the WRS test (WRS[G]),

randomization test, or test of proportions. Selection of the specific tests depends on the relative frequency of detection and sample size of each of the populations being compared. A second tier of testing is contingent on the results of the first tier tests, as shown on Figure E-5 and described below. Second tier testing is designed to compare the right-hand tails or upper quantiles of the site and background populations using the quantile test. One-sided statistical tests are used in all cases and employ a Type I error rate of 0.05 (5 percent).

Wilcoxon rank sum and Gehan-Wilcoxon tests: For metals with at least 60 percent detected data and at least 10 measurements in both the site and background populations, testing was performed using either the nonparametric WRS or WRS(G) test (DON 1999, 2002).

The following H_0 and H_A hypotheses were tested:

H_0: The median metal concentration for the site is less than or equal to the median concentration in the background population.

H_A: The median metal concentration for the site is greater than the median concentration in the background population.

The WRS test was used for samples with a single detection limit, and the WRS(G) test was used for samples with multiple detection limits, as described in DON (1999, 2002). The reporting limit was substituted for all censored data analyzed using the WRS or WRS(G) test. For cases where either the site or background population contained fewer than 10 samples, a randomization test of the medians was performed instead of the WRS or WRS(G) test. Details of the approach for implementing a randomization test of the median concentrations are provided in numerous technical sources on resampling (see Noreen 1989; Todman 2001; Edgington 1995).

In cases where the detection frequency in the site or background population was less than 60 percent, two additional tests, the test of proportions and the quantile test, were performed. The quantile test was also performed in cases where the WRS or WRS(G) test results concluded that the site median concentration did not exceed the background median concentration (Figure E-5). Each of these tests is described below.

Test of Proportions: For metals with fewer than 60 percent detected data, the detection frequencies in the site and background populations were compared using the test of proportions. Tests of proportions used a contingency table approach, and the significance of the tests was determined using the Fisher exact test. (The DON [1999, 2002] describes an approach for conducting the test of proportions using a normal approximation to the binomial distribution, which can also be used if software is not available for implementing the Fisher exact test.) Details on the Fisher exact test can be found in standard textbooks on statistics, such as Zar (1996).

The following H_0 and H_A hypotheses were tested using the test of proportions:

H_0: The proportion of detected measurements greater than C at the site is less than or equal to the proportion of measurements greater than C in the background population.

H_A: The proportion of detected measurements greater than C at the site is greater than the proportion of measurements greater than C in the background population.

In the H_0 and H_A statements above, C is defined as a concentration that is slightly larger than the maximum censored datum in the background data set.

Quantile Test: The quantile test (Johnson and others 1987; EPA 1994, 2000, 2002; DON 1998, 1999, 2002) was conducted for all metals with less than 60 percent detected data and for all cases where either the WRS, WRS(G), or randomization test did not reject H_0; that is, when it was concluded that the median site and ambient concentrations were not significantly different.

The quantile test is a nonparametric two-population test developed for comparing the right-hand tails or upper quantiles of two distributions. The quantile test can be used when some proportion of high-value measurements (rather than the entire distribution) of one population has shifted relative to a second population. The quantile test is not as powerful as the WRS test when the distribution of site concentrations is shifted in its entirety to the right of the background distribution. However, the quantile test is more powerful than the WRS test for detecting cases where only a small number of high-value measurements are present in the upper quantile of the site distribution. For this reason, EPA and Navy guidance recommends using the quantile test in conjunction with the WRS test (EPA 1994, 2000, 2002; DON 1999, 2002). When applied together, these tests have more power to detect true differences between two population distributions.

The quantile test is easy to apply and consists of looking at the largest r measurements in the pooled (and ordered) site and background data sets and counting the number of r measurements that are from the site. If k or more of the r measurements are site measurements, the quantile test declares that the upper range of concentrations at the site is elevated relative to the background population. All of the r-largest concentrations must be detected values; otherwise, the quantile test cannot be performed. The H_o addressed by the quantile test is that $\varepsilon \leq 0$ and $\Delta/\sigma \leq 0$, where ε is the proportion of site measurements that have shifted to the right and Δ/σ is the magnitude (in units of standard deviation, σ) of the shift.

EPA and Navy guidance provide critical values for the quantile test (EPA 1994, 2000; DON 1999, 2002). For cases where the sample sizes for the site or background populations exceeded the range of values provided in these tables (that is, either the site or background sample size exceeded 100) or the paired values for the site and background population did not exactly match the tabulated values, the critical probabilities were derived using Monte Carlo simulation. The

stochastic model developed for calculating critical values of the quantile test was validated by successfully reproducing the published critical values for site and background population sizes in the range of 5 to 100.

Again, it should be noted that the WRS (or WRS[G] or randomization) test, the quantile test, and the test of proportions are applied sequentially. The quantile test and the test of proportions are also conditional tests in this scheme (Figure E-5). That is, if H_0 (site median concentration is less than or equal to background) is rejected under the WRS (or WRS[G] or randomization) test, then no further testing is necessary and the chemical is treated as exceeding background. Failure to reject H_0 triggers implementation of the quantile test. In cases where the detection frequency is less than 60 percent, both the test of proportions and quantile test are applied. Independent conclusions are reported for both the quantile test and test of proportions, so failure of either test can result in a conclusion that the site population exceeds background. However, in cases where the only difference between the site and background populations is based on the test of proportions, site-specific information and professional judgment were used in a weight of evidence process to ultimately determine whether treating a chemical as exceeding background was justified.

4.0 REFERENCES

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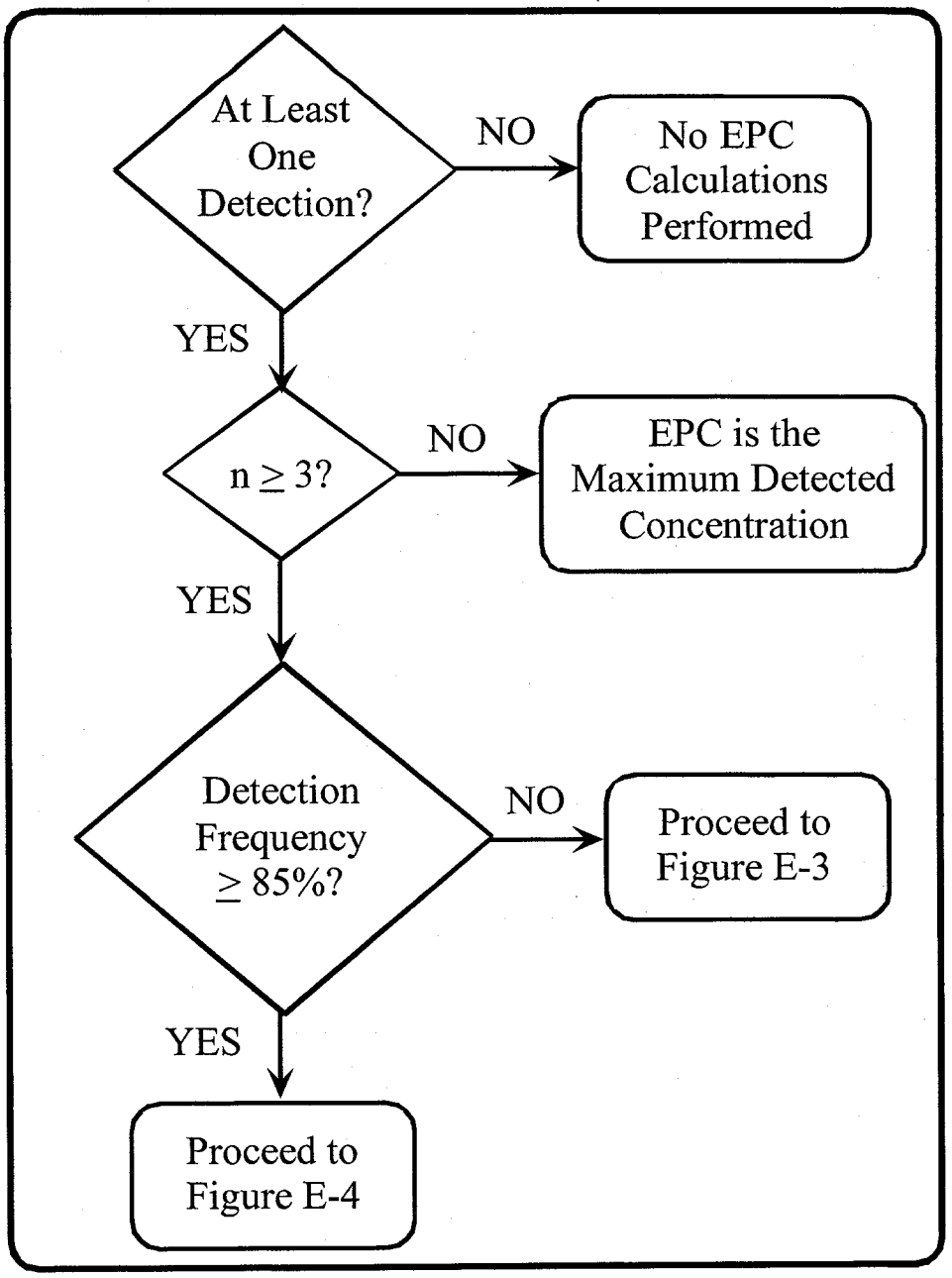
FIGURES

FIGURE E-1

FLOW CHART FOR SELECTING METHODS FOR CALCULATING EPCS

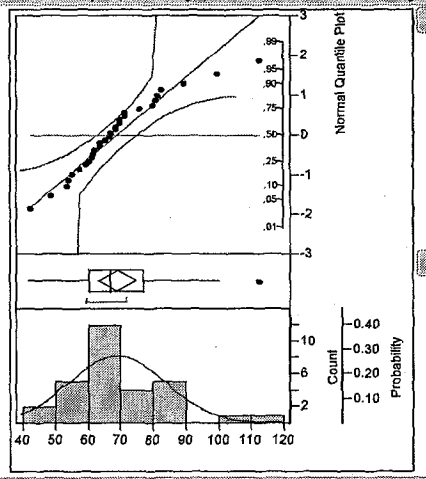


Notes:

DF Detection frequency
EPC Exposure point concentration
n Sample size

FIGURE E-2
EXAMPLES OF PLOTS AND GOODNESS-OF-FIT TESTS USED TO DETERMINE IF CHEMICALS FOLLOW A NORMAL, LOGNORMAL, OR GAMMA DISTRIBUTION

Site = Example (0-10 ft bgs) -- Metals -- Vanadium -- mg/kg -- Normal Fit



Quantiles

100.0%	maximum	113.00
99.5%		113.00
97.5%		113.00
90.0%		89.20
75.0%	quartile	77.15
50.0%	median	67.05
25.0%	quartile	60.55
10.0%		54.11
2.5%		42.50
0.5%		42.50
0.0%	minimum	42.50

Fitted Normal

Parameter Estimates

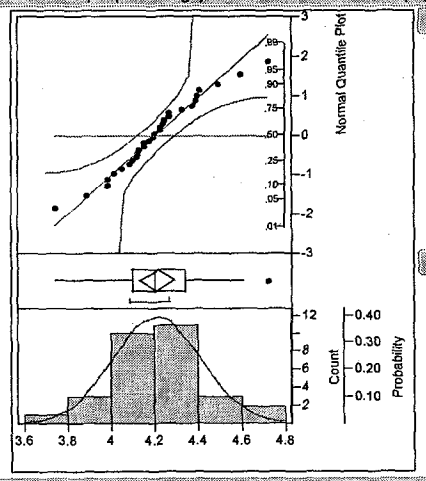
Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	Mu	69.17333	63.69826	74.64841
Dispersion	Sigma	14.66252	11.67734	19.71105

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.936976	0.0754

Site =Example (0-10 ft bgs) -- Metals -- Vanadium -- ln(mg/kg) -- Lognormal Fit



Quantiles

100.0%	maximum	4.7274
99.5%		4.7274
97.5%		4.7274
90.0%		4.4906
75.0%	quartile	4.3455
50.0%	median	4.2054
25.0%	quartile	4.1034
10.0%		3.9910
2.5%		3.7495
0.5%		3.7495
0.0%	minimum	3.7495

Fitted Normal

Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	Mu	4.216267	4.140415	4.292119
Dispersion	Sigma	0.203136	0.161779	0.273078

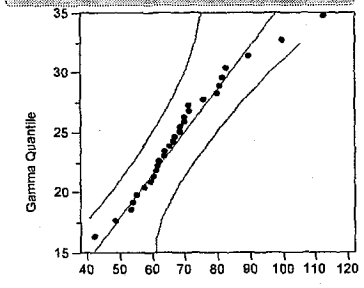
Goodness-of-Fit Test

Shapiro-Wilk W Test

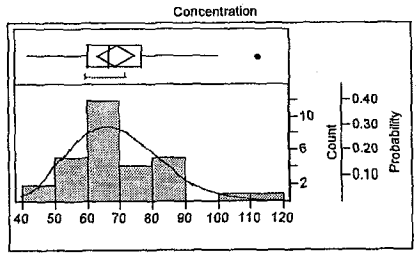
W	Prob<W
0.981295	0.8589

Site =Example (0-10 ft bgs) -- Metals -- Vanadium -- mg/kg -- Gamma Fit

Quantile Plot



Concentration



Fixed Parameters

Parameter	Value	Fixed	Lower 95%	Upper 95%
Alpha	24.73764	*	.	.
Sigma	2.79628	*	.	.
Theta	0.00000		.	.

Adequacy LR Test

ChiSquare	p-Value
0.00000	1.000000

Note: H0=New restricted parameterization adequately describes data.
Small p-values are evidence against new parameterization.

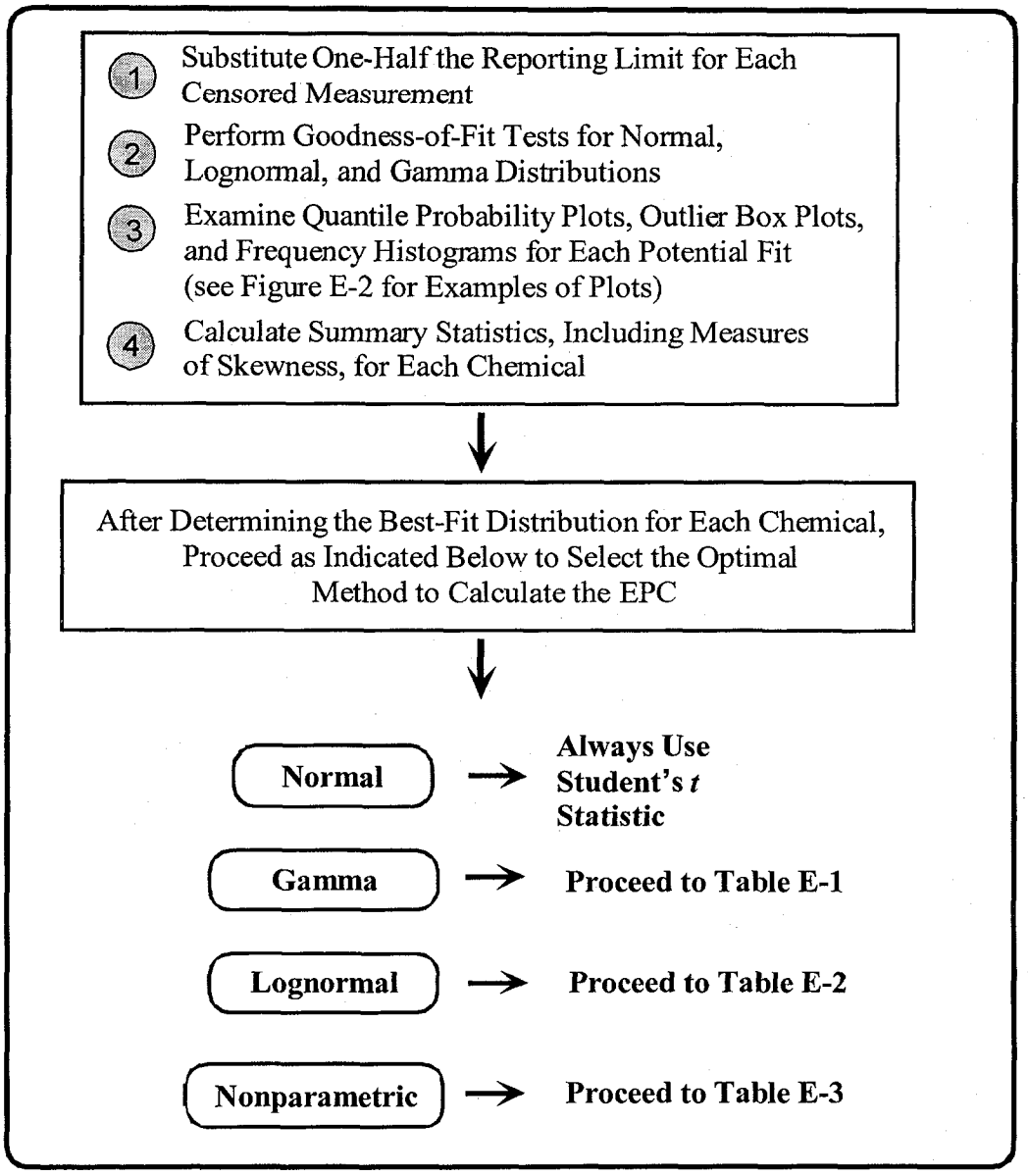
Goodness-of-Fit Test

Cramer-von Mises W Test

W-Square		Prob>W^2
0.060196	>	0.2500

FIGURE E-3

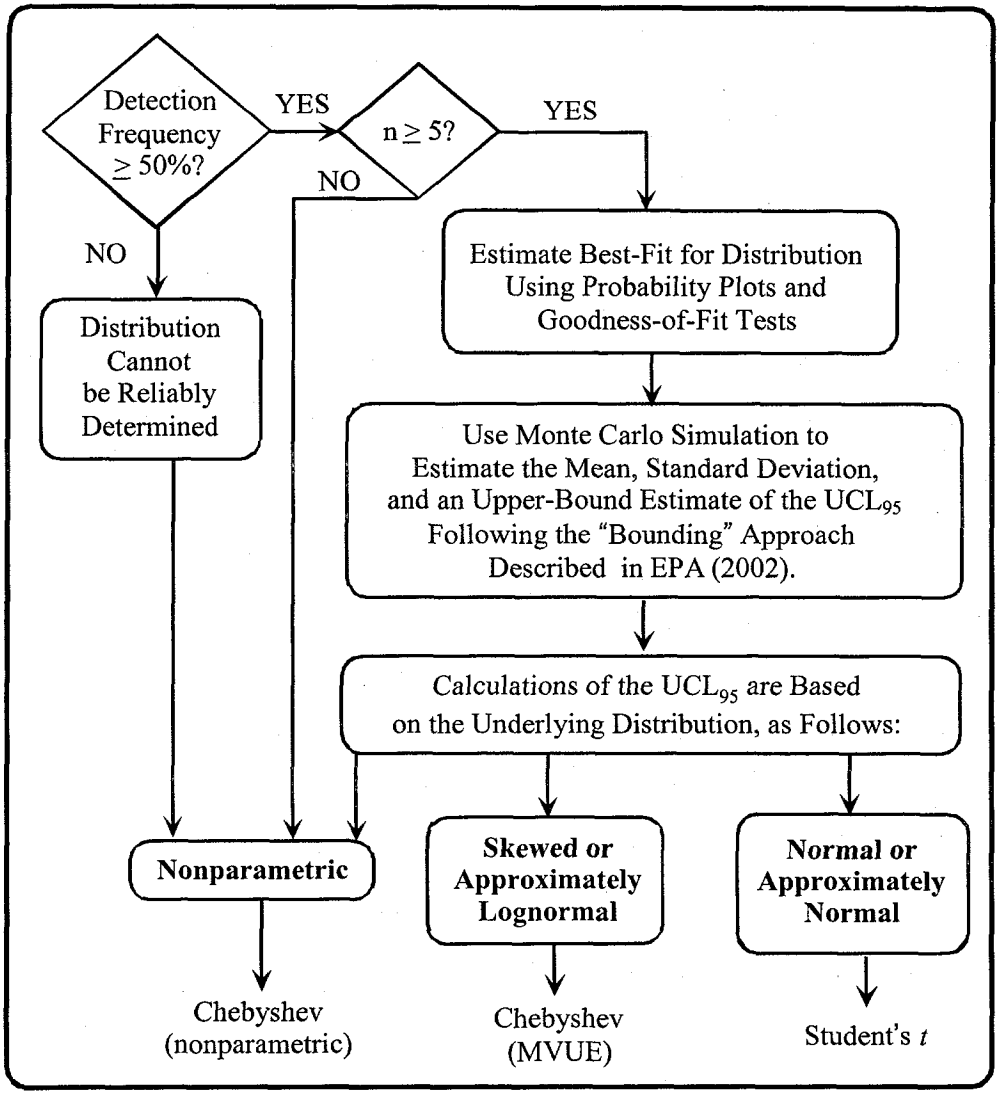
METHODS RECOMMENDED BY EPA FOR ESTIMATING EPCS WHEN THE DF IS AT LEAST 85 PERCENT



Notes:

DF Detection frequency
EPA U.S. Environmental Protection Agency
EPC Exposure point concentration

FIGURE E-4
FLOWCHART ILLUSTRATING CALCULATION OF THE EPC WHEN DETECTION FREQUENCIES ARE LESS THAN 85 PERCENT

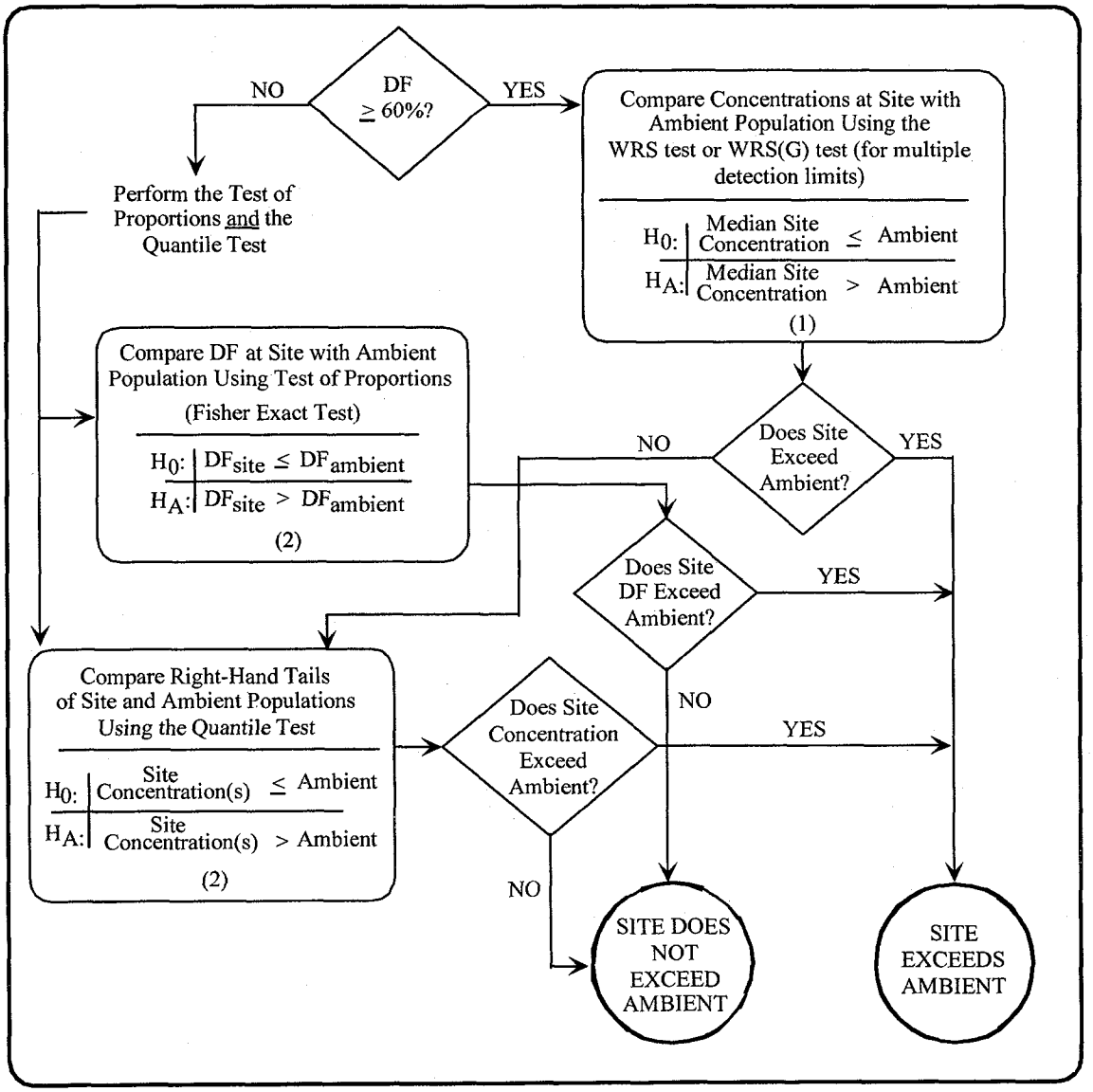


Notes:

EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
s	Sample standard deviation
UCL_{95}	The one-sided upper 95 percent confidence limit of the mean
MVUE	Minimum variance unbiased estimate

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Office of Emergency and Remedial Response. Washington, D.C. December.

FIGURE E-5
FLOWCHART SHOWING THE BACKGROUND SCREENING PROCESS FOR METALS IN SOIL AND GROUNDWATER



Notes:

(1) When either the site or ambient population contains fewer than 10 measurements, a randomization test of the medians is substituted

(2) Both the test of proportions and quantile test are performed in the following cases: (1) H_0 is not rejected under the WRS, WRS(G), or randomization tests, and (2) the sample DF is less than 60 percent. Independent conclusions are drawn from these tests, and chemicals can be identified as exceeding background based on either test.

DF Detection frequency
H_0 Null hypothesis
H_A Alternative hypothesis
WRS Wilcoxon rank sum test
WRS(G) Gehan-Wilcoxon rank sum test

TABLES

TABLE E-1: EPA RECOMMENDATIONS FOR CALCULATING A UCL FOR GAMMA DISTRIBUTIONS

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

$\hat{k}$	Sample Size (n)	Recommended Method
$\hat{k} \geq 0.50$	All n	UCL_{95}, Approximate Gamma
$0.10 \leq \hat{k} < 0.50$	All n	UCL_{95}, Adjusted Gamma
$\hat{k} < 0.10$	n < 15	UCL_{99}, Chebyshev (nonparametric)
$\hat{k} < 0.10$	n ≥ 15	$UCL_{97.5}$, Chebyshev (nonparametric)

Notes:

$\hat{k}$ Maximum likelihood estimator for the shape parameter of a gamma distribution
EPA U.S. Environmental Protection Agency
UCL One-sided upper confidence limit of the mean

TABLE E-2: EPA RECOMMENDATIONS FOR CALCULATING A UCL FOR LOGNORMAL DISTRIBUTIONS

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

$\hat{\sigma}$	Sample Size (n)	Recommended Method
$\hat{\sigma} < 0.50$	All n	UCL_{95}, Student's *t*
$0.50 \leq \hat{\sigma} < 1.0$	All n	UCL_{95}, Land's (H-Statistic)
$1.0 \leq \hat{\sigma} < 1.5$	n < 25	UCL_{95}, MVUE Chebyshev
	n ≥ 25	UCL_{95}, Land's (H-Statistic)
$1.5 \leq \hat{\sigma} < 2.0$	n < 20	UCL_{99}, MVUE Chebyshev
	20 ≤ n < 50	UCL_{95}, MVUE Chebyshev
	n ≥ 50	UCL_{95}, Land's (H-Statistic)
$2.0 \leq \hat{\sigma} < 2.5$	n < 20	UCL_{99}, MVUE Chebyshev
	20 ≤ n < 50	$UCL_{97.5}$, MVUE Chebyshev
	50 ≤ n < 70	UCL_{95}, MVUE Chebyshev
	n ≥ 70	UCL_{95}, Land's (H-Statistic)
$2.5 \leq \hat{\sigma} < 3.0$	n < 30	Larger of UCL_{99}, MVUE Chebyshev, and UCL_{99}, Chebyshev (nonparametric)
	30 ≤ n < 70	$UCL_{97.5}$, MVUE Chebyshev
	70 ≤ n < 100	UCL_{95}, MVUE Chebyshev
	n ≥ 100	UCL_{95}, Land's (H-Statistic)
$3.0 \leq \hat{\sigma} < 3.5$	n < 15	Hall's Bootstrap (or UCL_{99}, MVUE Chebyshev)
	15 ≤ n < 50	Larger of UCL_{99}, MVUE Chebyshev, and UCL_{99}, Chebyshev (nonparametric)
	50 ≤ n < 100	$UCL_{97.5}$, MVUE Chebyshev
	100 ≤ n < 150	UCL_{95}, MVUE Chebyshev
	n ≥ 150	UCL_{95}, Land's (H-Statistic)
$\hat{\sigma} > 3.5$	All n	Use nonparametric methods

Notes:

$\hat{\sigma}$ Standard deviation of the natural logarithms of the data
EPA U.S. Environmental Protection Agency
MVUE Minimum variance unbiased estimator
UCL One-side upper confidence limit of the mean

TABLE E-3: EPA RECOMMENDATIONS FOR CALCULATING A UCL FOR NONPARAMETRIC DISTRIBUTIONS

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

$\hat{\sigma}$	Sample Size (n)	Recommended Method
$\hat{\sigma} \leq 0.50$	All n	UCL_{95}, Student's *t*
$0.50 < \hat{\sigma} \leq 1.0$	All n	UCL_{95}, Chebyshev (nonparametric)
$1.0 < \hat{\sigma} \leq 2.0$	n < 50	UCL_{99}, Chebyshev (nonparametric)
	n ≥ 50	$UCL_{97.5}$, Chebyshev (nonparametric)
$2.0 < \hat{\sigma} \leq 3.0$	n < 10	Hall's Bootstrap (or UCL_{99}, Chebyshev [nonparametric])
	n ≥ 10	UCL_{99}, Chebyshev (nonparametric)
$3.0 < \hat{\sigma} \leq 3.5$	n < 30	Hall's Bootstrap (or UCL_{99}, Chebyshev [nonparametric])
	n ≥ 30	UCL_{99}, Chebyshev (nonparametric)
$\hat{\sigma} > 3.5$	n < 100	Hall's Bootstrap (or UCL_{99}, Chebyshev [nonparametric])
	n ≥ 100	UCL_{99}, Chebyshev (nonparametric)

Notes:

$\hat{\sigma}$ Standard deviation of the natural logarithms of the data
EPA U.S. Environmental Protection Agency
UCL One-side upper confidence limit of the mean

TABLE E-4: SUMMARY STATISTICS FOR PINK SOIL DATA SET

Appendix E, OU-2B Remedial Investigation Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Analyte Group	Chemical	Distribution[a]	SUMMARY STATISTICS												
			Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected & Censored Data					
			Detected	Total		Min	Max	Min	Max	Median[b]	Q95[b]	Mean[c]	SD[c]	CV	UCL_{95}[d]
Total Metals	Aluminum	Lognormal	55	55	100	N/A	N/A	1,760.00	22,600.00	5,230.00	13,960.00	5,799.87	374.73	0.06	6,521.20
	Antimony	Not Tested	18	55	33	0.46	11.00	0.70	8.60	2.60	9.50	2.77	0.66	0.24	3.82
	Arsenic	Unknown[b]	45	55	82	0.59	10.00	0.44	15.60	1.70	9.14	2.58	0.38	0.15	4.21
	Barium	Lognormal	55	55	100	N/A	N/A	6.91	156.00	32.50	93.68	41.33	3.15	0.08	47.55
	Beryllium	Unknown[a]	28	55	51	0.15	1.00	0.25	1.47	0.58	1.27	0.50	0.37	0.75	0.61
	Cadmium	Not Tested	11	55	20	0.08	1.19	0.10	3.19	0.33	1.72	0.36	0.09	0.24	0.71
	Calcium	Unknown[b]	55	55	100	N/A	N/A	816.00	66,600.00	2,400.00	16,800.00	3,805.34	419.95	0.11	4,704.82
	Chromium	Lognormal	55	55	100	N/A	N/A	15.60	66.70	29.20	54.84	30.31	1.23	0.04	32.56
	Cobalt	Unknown[b]	48	55	87	3.96	5.70	3.02	49.70	4.70	14.30	5.68	0.45	0.08	6.58
	Copper	Unknown[b]	52	55	95	8.80	10.20	3.12	49.10	6.91	39.14	8.95	0.77	0.09	10.51
	Iron	Unknown[b]	55	55	100	N/A	N/A	4,500.00	27,900.00	8,590.00	22,280.00	10,108.88	555.72	0.05	11,154.70
	Lead	Unknown[b]	51	55	93	1.90	3.00	0.47	165.00	3.20	37.66	7.05	1.20	0.17	9.98
	Magnesium	Unknown[b]	55	55	100	N/A	N/A	1,290.00	8,800.00	2,320.00	7,304.00	2,859.91	166.36	0.06	3,175.36
	Manganese	Unknown[b]	55	55	100	N/A	N/A	55.50	748.00	108.00	383.00	145.19	11.12	0.08	167.20
	Mercury	Not Tested	7	54	13	0.05	0.27	0.06	2.71	0.10	0.52	0.11	0.02	0.23	0.36
	Molybdenum	Not Tested	0	16	0	2.80	5.20	N/A	N/A	3.10	5.20	N/A	N/A	N/A	N/A
	Nickel	Unknown[b]	55	55	100	N/A	N/A	11.50	80.40	24.30	55.72	27.22	1.25	0.05	29.53
	Potassium	Lognormal	55	55	100	N/A	N/A	209.00	2,480.00	691.00	1,232.00	740.63	42.05	0.06	820.09
	Selenium	Not Tested	0	55	0	0.18	10.00	N/A	N/A	0.42	1.78	N/A	N/A	N/A	N/A
	Silver	Not Tested	11	55	20	0.18	5.20	0.32	5.64	0.54	2.22	0.53	0.12	0.22	1.12
	Sodium	Lognormal	54	55	98	520.00	520.00	62.60	1,580.00	325.00	1,230.00	411.81	40.19	0.10	495.34
	Thallium	Not Tested	0	55	0	0.11	10.00	N/A	N/A	0.30	0.50	N/A	N/A	N/A	N/A
	Titanium	Not Tested	1	1	100	N/A	N/A	518.00	518.00	518.00	518.00	N/A	N/A	N/A	N/A
	Vanadium	Unknown[b]	55	55	100	N/A	N/A	10.50	55.30	21.00	47.34	22.52	1.07	0.05	24.50
	Zinc	Unknown[b]	54	55	98	18.00	18.00	9.98	191.00	20.60	67.48	25.66	1.85	0.07	29.27

Notes:

Concentration units are in milligram(s) per kilogram.
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations.
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach from EPA (2002), as described below under notes c and d.
No calculations of the mean, SD, CV, or UCL95 are performed for sample sizes less than 3 or detection frequencies of zero.

a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."
For cases in which distributions could not be confirmed using the Shipiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b Estimated for all samples using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c For all samples with at least one detection, calculated using distribution-dependent formulae.
For confirmed or estimated normal distributions with fewer than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).
For confirmed or estimated lognormal distributions with fewer than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
All other calculations use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002) [see conceptual model in Figure E-5 and text in methods section for more details].

d For confirmed or estimated normal distributions with fewer than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).
For confirmed or estimated lognormal distributions with fewer than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002) [see conceptual model in Figure E-5 and text in methods section for more details]. Calculations are based on either normal or lognormal (nonparametric Chebyshev inequality) model equations.

TABLE E-4: SUMMARY STATISTICS FOR PINK SOIL DATA SET

Appendix E, OU-2B Remedial Investigation Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Notes (Continued):

CV	Coefficient of variation (SD/mean)
Min	Minimum concentration reported
Max	Maximum concentration reported
N/A	Not applicable
Q95	95th percentile (quantile)
SD	Standard deviation
UCL_{95}	The one-sided 95 percent upper confidence limit of the mean
Unknown[a]	Distribution assumed to be normal based on examination of probability plots and outlier box plots
Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots and outlier box plots

References:

Gilbert, R. O. 1987. Statistical Methods for Environmental Pollution Monitoring. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December.

TABLE E-5: SUMMARY STATISTICS FOR BLUE SOIL DATA SET

Appendix E, OU-2B Remedial Investigation Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

			SUMMARY STATISTICS											
			Sample Size		Detection	Censored Data		Detected Data		Detected & Censored Data				
Analyte Group	Chemical	Distribution[a]	Detected	Total	Frequency (Percent)	Min	Max	Min	Max	Median[b]	Q95[b]	Mean[c]	SD[c]	CV	UCL_{95}[d]
Total Metals	Aluminum	Unknown[b]	88	88	100	N/A	N/A	2,880.00	26,800.00	4,965.00	16,000.00	6,417.49	352.02	0.05	7,073.70
	Antimony	Not Tested	2	88	2	0.46	9.20	0.89	1.00	2.40	7.71	2.16	0.39	0.18	2.90
	Arsenic	Not Tested	33	88	38	0.61	13.00	0.74	23.00	2.90	16.55	4.59	0.95	0.21	6.39
	Barium	Unknown[b]	85	88	97	24.00	25.00	0.30	198.00	38.75	114.60	53.01	5.04	0.10	63.26
	Beryllium	Not Tested	25	88	28	0.20	1.30	0.09	0.77	0.30	1.20	0.37	0.06	0.15	0.49
	Cadmium	Not Tested	29	88	33	0.06	1.30	0.10	0.82	0.30	1.20	0.40	0.08	0.19	0.49
	Calcium	Unknown[b]	88	88	100	N/A	N/A	1,360.00	19,200.00	2,600.00	14,165.00	3,683.74	267.39	0.07	4,201.93
	Chromium	Unknown[b]	88	88	100	N/A	N/A	11.40	81.70	29.50	64.26	33.50	1.25	0.04	35.74
	Cobalt	Lognormal	66	88	75	3.94	6.80	1.90	14.00	5.35	12.04	5.37	0.45	0.08	6.45
	Copper	Unknown[b]	83	88	94	5.80	6.30	4.20	89.40	9.70	40.35	13.12	1.07	0.08	15.23
	Iron	Unknown[b]	88	88	100	N/A	N/A	760.00	26,900.00	8,140.00	20,995.00	10,072.09	548.13	0.05	11,092.99
	Lead	Not Tested	27	88	31	1.40	6.80	1.30	41.00	5.90	13.01	5.31	0.88	0.17	7.54
	Magnesium	Unknown[b]	88	88	100	N/A	N/A	1,510.00	42,400.00	2,240.00	6,503.00	2,867.67	154.94	0.05	3,156.01
	Manganese	Unknown[b]	88	88	100	N/A	N/A	50.00	1,060.00	108.50	340.75	143.63	8.45	0.06	159.52
	Mercury	Not Tested	0	22	0	0.07	0.18	N/A	N/A	0.17	0.18	N/A	N/A	N/A	N/A
	Molybdenum	Not Tested	0	85	0	0.31	6.50	N/A	N/A	1.40	6.20	N/A	N/A	N/A	N/A
	Nickel	Unknown[b]	88	88	100	N/A	N/A	11.60	88.50	23.80	64.13	29.17	1.35	0.05	31.64
	Potassium	Unknown[b]	87	88	99	610.00	610.00	310.00	6,382.00	769.50	2,310.00	902.98	50.21	0.06	996.73
	Selenium	Not Tested	1	88	1	0.43	13.00	5.70	5.70	5.00	12.00	4.05	0.97	0.24	4.67
	Silver	Not Tested	2	88	2	0.18	6.50	0.44	0.61	0.70	6.20	1.07	0.27	0.25	1.88
	Sodium	Unknown[b]	68	88	77	288.00	650.00	88.10	3,510.00	340.00	1,544.50	422.62	47.51	0.11	718.20
	Thallium	Not Tested	1	88	1	0.36	13.00	5.30	5.30	3.10	12.00	3.20	0.83	0.26	4.16
	Titanium	Lognormal	66	66	100	N/A	N/A	223.00	1,020.00	372.50	701.20	407.10	16.33	0.04	436.76
	Vanadium	Unknown[b]	88	88	100	N/A	N/A	12.80	62.30	20.00	41.78	22.23	0.81	0.04	23.68
	Zinc	Unknown[b]	88	88	100	N/A	N/A	14.00	84.00	24.85	65.38	28.55	1.30	0.05	30.93

Notes:

Concentration units are in milligram(s) per kilogram.
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations.
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach from EPA (2002), as described below under notes c and d.
No calculations of the mean, SD, CV, or UCL95 are performed for sample sizes less than 3 or detection frequencies of zero.

a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."
For cases in which distributions could not be confirmed using the Shipiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b Estimated for all samples using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c For all samples with at least one detection, calculated using distribution-dependent formulae.
For confirmed or estimated normal distributions with fewer than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).
For confirmed or estimated lognormal distributions with fewer than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
All other calculations use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002) [see conceptual model in Figure E-5. and text in methods section for more details].

d For confirmed or estimated normal distributions with fewer than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).
For confirmed or estimated lognormal distributions with fewer than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002) [see conceptual model in Figure E-5 and text in methods section for more details]. Calculations are based on either normal or lognormal (nonparametric Chebyshev inequality) model equations.

TABLE E-5: SUMMARY STATISTICS FOR BLUE SOIL DATA SET

Appendix E, OU-2B Remedial Investigation Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Notes (Continued):

CV	Coefficient of variation (SD/mean)
Min	Minimum concentration reported
Max	Maximum concentration reported
N/A	Not applicable
Q95	95th percentile (quantile)
SD	Standard deviation
UCL_{95}	The one-sided 95 percent upper confidence limit of the mean
Unknown[a]	Distribution assumed to be normal based on examination of probability plots and outlier box plots
Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots and outlier box plots

References:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December.

TABLE E-6: SUMMARY STATISTICS FOR THE BACKGROUND GROUNDWATER DATA SET

Appendix E, OU-2B RI Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Analyte Group	Chemical	Distribution[a]	SUMMARY STATISTICS											
			Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected & Censored Data				
			Detected	Total		Min	Max	Min	Max	Median[b]	Q95[b]	Mean[c]	SD[c]	CV	UCL_{95}[d]
Dissolved Metals	Aluminum	Not Tested	56	194	29	0.0081	0.2860	0.0030	4.5300	0.0408	1.0700	0.1931	0.6620	3.43	0.4018
	Antimony	Not Tested	13	194	7	0.0007	0.0440	0.0019	0.0478	0.0065	0.0375	0.0083	0.0099	1.19	0.0123
	Arsenic	Lognormal	107	198	54	0.0010	0.1000	0.0014	0.0407	0.0053	0.0207	0.0081	0.0010	0.13	0.0158
	Barium	Unknown[b]	161	194	83	0.0043	0.3400	0.0023	1.2600	0.0425	0.5695	0.1347	0.0304	0.23	0.3298
	Beryllium	Not Tested	18	194	9	0.0001	0.0037	0.0009	0.0030	0.0010	0.0025	0.0007	0.0007	1.02	0.0009
	Cadmium	Not Tested	22	194	11	0.0002	0.0080	0.0002	0.0034	0.0006	0.0039	0.0009	0.0010	1.21	0.0013
	Calcium	Unknown[b]	194	198	98	0.8980	1.3700	0.6200	513.0000	21.3000	156.9500	57.3059	11.1866	0.20	76.7281
	Chromium	Not Tested	33	194	17	0.0002	0.0320	0.0006	0.0828	0.0023	0.0125	0.0031	0.0073	2.31	0.0056
	Chromium(VI)	Not Tested	1	7	14	0.0100	0.1000	0.0040	0.0040	0.0100	0.1000	0.0177	0.0268	1.51	0.0917
	Cobalt	Not Tested	12	194	6	0.0003	0.0172	0.0008	0.0105	0.0061	0.0172	0.0039	0.0038	0.99	0.0055
	Copper	Not Tested	60	194	31	0.0004	0.0697	0.0018	0.0273	0.0059	0.0242	0.0060	0.0070	1.17	0.0087
	Iron	Unknown[b]	130	198	66	0.0048	0.3630	0.0072	24.4000	0.1305	6.5855	2.0403	1.1817	0.58	9.3908
	Lead	Not Tested	17	195	9	0.0005	0.0200	0.0012	0.0284	0.0013	0.0067	0.0013	0.0027	2.05	0.0024
	Magnesium	Unknown[b]	198	198	100	N/A	N/A	0.5490	1,070.0000	15.1500	356.0000	67.9087	18.6714	0.27	98.1515
	Manganese	Unknown[b]	187	198	94	0.0008	0.0123	0.0011	2.4800	0.1315	1.7410	0.8066	0.3563	0.44	1.3736
	Mercury	Not Tested	4	198	2	0.0001	0.0003	0.0002	0.0006	0.0002	0.0002	0.0001	0.0001	0.73	0.0001
	Molybdenum	Not Tested	12	119	10	0.0003	0.0254	0.0005	0.0194	0.0096	0.0127	0.0045	0.0036	0.80	0.0064
	Nickel	Not Tested	23	198	12	0.0013	0.0491	0.0007	0.1510	0.0113	0.0210	0.0076	0.0151	1.98	0.0127
	Potassium	Lognormal	193	198	97	0.7630	2.3400	1.2000	505.0000	15.0000	147.1500	33.4114	4.4458	0.13	41.7490
	Selenium	Not Tested	1	193	1	0.0008	0.0540	0.0025	0.0025	0.0024	0.0084	0.0015	0.0024	1.55	0.0029
	Silver	Not Tested	4	188	2	0.0002	0.0054	0.0002	0.0048	0.0020	0.0049	0.0014	0.0013	0.98	0.0019
	Sodium	Unknown[b]	198	198	100	N/A	N/A	4.6000	8,160.0000	140.5000	3,714.0000	660.4794	146.4784	0.22	907.9395
	Thallium	Not Tested	3	193	2	0.0009	0.0760	0.0036	0.0052	0.0027	0.0138	0.0021	0.0037	1.77	0.0041
	Vanadium	Not Tested	72	198	36	0.0003	0.0195	0.0020	0.0508	0.0070	0.0263	0.0073	0.0092	1.25	0.0103
	Zinc	Not Tested	65	198	33	0.0005	0.0818	0.0028	46.8000	0.0078	0.0364	0.2470	3.3253	13.46	1.2774

Notes:

Concentration units are in milligram(s) per liter.
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations.
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach from EPA (2002), as described below under notes c and d.
No calculations of the mean, SD, CV, or UCL95 are performed for sample sizes less than 3 or detection frequencies of zero.

a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."
For cases in which distributions could not be confirmed using the Shipiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b Estimated for all samples using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c For all samples with at least one detection, calculated using distribution-dependent formulae.
For confirmed or estimated normal distributions with fewer than 15 percent censored data and for distributions listed as "Not Tested", calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (
For confirmed or estimated lognormal distributions these are the MVU estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
For samples with greater than 15 percent censored data these are the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002) [see conceptual model in Figure E-5 and text in methods section for more details].

d For confirmed or estimated normal distributions, calculated using equation 11.6 in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
For confirmed or estimated lognormal distributions with greater than 15 percent censored data, calculated using the MVUE Chebyshev method (EPA 2002).
For samples with greater than 15 percent censored data and distributions listed as "Not Tested", calculated using the nonparametric Chebyshev method.
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002) [see conceptual model in Figure E-5 and text in methods section for more details].

CV Coefficient of variation (SD/mean)
Min Minimum concentration reported
Max Maximum concentration reported
MVU Minimum variance unbiased
MVUE Minimum variance unbiased estimator
N/A Not applicable

TABLE E-6: SUMMARY STATISTICS FOR THE BACKGROUND GROUNDWATER DATA SET

Appendix E, OU-2B RI Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Notes (Continued):

Q95 95th percentile (quantile)
SD Standard deviation
UCL_{95} The one-sided 95 percent upper confidence limit of the mean
Unknown[a] Distribution assumed to be normal based on examination of probability plots and outlier box plots
Unknown[b] Distribution assumed to be lognormal based on examination of probability plots and outlier box plots

References

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December.

TABLE E-7: SOIL BACKGROUND COMPARISON

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Chemical	OU-2B Site 3 Soil (0-8 feet bgs) Sample Size Detected	Sample Size Total	Detection Frequency	Alameda Ambient (Pink) Sample Size Detected	Sample Size Total	Detection Frequency	1st Tier Statistical Test[a] Test	Prob[b]	Quantile Test Conclusion (Tier 2)$_c$	Site > Ambient? (YES or NO)
Aluminum	45	45	100	55	55	100	WRS	0.001	N/A	YES
Antimony	3	49	6	18	55	33	TP	1.000	(2)	NO
Arsenic	26	45	58	45	55	82	TP	0.063	(2)	NO
Barium	44	45	98	55	55	100	WRS	0.009	N/A	YES
Beryllium	16	49	33	28	55	51	TP	0.957	(2)	NO
Cadmium	10	49	20	11	55	20	TP	0.780	(2)	NO
Calcium	45	45	100	55	55	100	WRS	0.071	Site ≤ Ambient	NO
Chromium	44	49	90	55	55	100	WRS(G)	0.182	Site ≤ Ambient	NO
Cobalt	39	45	87	48	55	87	WRS(G)	0.001	N/A	YES
Copper	41	49	84	52	55	95	WRS(G)	<0.001	N/A	YES
Iron	45	45	100	55	55	100	WRS	<0.001	N/A	YES
Lead	86	99	87	51	55	93	WRS(G)	<0.001	N/A	YES
Magnesium	45	45	100	55	55	100	WRS	0.001	N/A	YES
Manganese	45	45	100	55	55	100	WRS	0.003	N/A	YES
Mercury	13	40	32	7	54	13	TP	0.065	(2)	NO
Nickel	47	49	96	55	55	100	WRS(G)	0.066	Site ≤ Ambient	NO
Potassium	45	45	100	55	55	100	WRS	0.004	N/A	YES
Silver	3	49	6	11	55	20	TP	1.000	(2)	NO
Sodium	32	45	71	54	55	98	WRS(G)	0.622	Site > Ambient	YES
Thallium	8	45	18	0	55	0	TP	1.000	(2)	NO
Titanium	9	9	100	1	1	100	(3)	(3)	(3)	(3)
Vanadium	45	45	100	55	55	100	WRS	0.002	N/A	YES
Zinc	46	49	94	54	55	98	WRS	<0.001	N/A	YES

Notes:

a TP= test of proportions (implemented using the Fisher exact test)
WRS= Wilcoxon rank sum test
WRS(G)= Gehan-Wilcoxon test
H_0 is that site ≤ ambient

b Calculated significance level for individual statistical tests. Reject H_0 if Prob ≤ 0.05.

c Conducted in cases where the WRS/WRS(G) test cannot be performed, or when H_0 is not rejected by these tests

> Greater than

≤ Less than or equal to

bgs Below ground surface

H_0 Null hypothesis

N/A Not applicable, H_0 was rejected based on either the WRS or WRS(G) test .

1 The conclusion that the site exceeds ambient is based only on the comparison of detection frequencies, rather than the magnitude of chemical concentrations.

2 The quantile test could not be run because at least one of the largest r measurements was a censored value.

3 No Statistial tests were conducted because the ambient data set only had one measurement

TABLE E-8: SOIL BACKGROUND COMPARISON

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

	OU-2B Site 4 Soil (0-8 feet bgs)			Alameda Ambient (Blue)			1st Tier Statistical Test[a]		Quantile Test	Site > Ambient?
	Sample Size		Detection	Sample Size		Detection				
Chemical	Detected	Total	Frequency	Detected	Total	Frequency	Test	Prob[b]	Conclusion (Tier 2)$_c$	(YES or NO)
Aluminum	123	124	99	88	88	100	WRS	0.223	Site ≤ Ambient	NO
Antimony	20	148	14	2	88	2	TP	0.627	(2)	NO
Arsenic	83	127	65	33	88	38	TP	0.942	Site ≤ Ambient	NO
Barium	120	124	97	85	88	97	WRS(G)	0.002	N/A	YES
Beryllium	43	151	28	25	88	28	TP	0.157	(2)	NO
Cadmium	59	166	36	29	88	33	TP	<0.001	(2)	YES (1)
Calcium	123	124	99	88	88	100	WRS	<0.001	N/A	YES
Chromium	140	168	83	88	88	100	WRS(G)	0.201	Site > Ambient	YES
Cobalt	105	125	84	66	88	75	WRS(G)	0.181	Site ≤ Ambient	NO
Copper	126	156	81	83	88	94	WRS(G)	<0.001	N/A	YES
Iron	123	124	99	88	88	100	WRS	0.054	Site ≤ Ambient	NO
Lead	119	164	73	27	88	31	TP	<0.001	Site > Ambient	YES
Magnesium	123	124	99	88	88	100	WRS	0.179	Site ≤ Ambient	NO
Manganese	123	124	99	88	88	100	WRS	0.001	N/A	YES
Mercury	29	123	24	0	22	0	TP	0.217	(2)	NO
Molybdenum	7	105	7	0	85	0	TP	1.000	(2)	NO
Nickel	152	155	98	88	88	100	WRS(G)	<0.001	N/A	YES
Potassium	112	124	90	87	88	99	WRS(G)	0.817	Site ≤ Ambient	NO
Selenium	15	124	12	1	88	1	TP	1.000	(2)	NO
Silver	36	156	23	2	88	2	TP	0.010	(2)	YES (1)
Sodium	97	124	78	68	88	77	WRS(G)	0.786	Site ≤ Ambient	NO
Thallium	8	111	7	1	88	1	TP	1.000	(2)	NO
Titanium	27	27	100	66	66	100	WRS	0.653	Site ≤ Ambient	NO
Vanadium	118	124	95	88	88	100	WRS(G)	0.057	Site ≤ Ambient	NO
Zinc	141	150	94	88	88	100	WRS(G)	<0.001	N/A	YES

Notes:

a TP= test of proportions (implemented using the Fisher exact test)
WRS= Wilcoxon rank sum test
WRS(G)= Gehan-Wilcoxon test
H_0 is that site ≤ ambient

b Calculated significance level for individual statistical tests. Reject H_0 if Prob ≤ 0.05.

c Conducted in cases where the WRS/WRS(G) test cannot be performed, or when H_0 is not rejected by these tests

\> Greater than

≤ Less than or equal to

bgs Below ground surface

H_0 Null hypothesis

N/A Not applicable, H_0 was rejected based on either the WRS or WRS(G) test .

1 The conclusion that the site exceeds ambient is based only on the comparison of detection frequencies, rather than the magnitude of chemical concentrations.

2 The quantile test could not be run because at least one of the largest r measurements was a censored value.

TABLE E-9: SOIL BACKGROUND COMPARISON

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

	OU-2B Site 3 Soil (0-8 feet bgs)			Alameda Ambient (Pink)			1st Tier Statistical Test[a]		Quantile Test	Site > Ambient?
	Sample Size		Detection	Sample Size		Detection				
Chemical	Detected	Total	Frequency	Detected	Total	Frequency	Test	Prob[b]	Conclusion (Tier 2)[c]	(YES or NO)
Aluminum	79	80	99	55	55	100	WRS	0.061	Site ≤ Ambient	NO
Antimony	9	86	10	18	55	33	TP	1.000	(2)	NO
Arsenic	74	80	92	45	55	82	WRS(G)	0.323	(2)	NO
Barium	79	80	99	55	55	100	WRS	0.880	Site ≤ Ambient	NO
Beryllium	50	86	58	28	55	51	TP	0.263	(2)	NO
Cadmium	11	86	13	11	55	20	TP	0.734	(2)	NO
Calcium	79	80	99	55	55	100	WRS	0.039	N/A	YES
Chromium	78	86	91	55	55	100	WRS(G)	0.706	Site ≤ Ambient	NO
Cobalt	79	80	99	48	55	87	WRS(G)	<0.001	N/A	YES
Copper	75	86	87	52	55	95	WRS(G)	0.020	N/A	YES
Iron	79	80	99	55	55	100	WRS	0.003	N/A	YES
Lead	82	101	81	51	55	93	WRS(G)	0.052	Site ≤ Ambient	NO
Magnesium	79	80	99	55	55	100	WRS	<0.001	N/A	YES
Manganese	79	80	99	55	55	100	WRS	0.010	N/A	YES
Mercury	17	86	20	7	54	13	TP	0.630	(2)	NO
Molybdenum	1	63	2	0	16	0	TP	1.000	(2)	NO
Nickel	82	86	95	55	55	100	WRS(G)	0.011	N/A	YES
Potassium	75	80	94	55	55	100	WRS(G)	0.976	Site ≤ Ambient	NO
Selenium	2	80	2	0	55	0	TP	1.000	(2)	NO
Silver	4	86	5	11	55	20	TP	1.000	(2)	NO
Sodium	45	80	56	54	55	98	TP	0.984	Site ≤ Ambient	NO
Thallium	5	80	6	0	55	0	TP	1.000	(2)	NO
Vanadium	79	80	99	55	55	100	WRS	0.019	N/A	YES
Zinc	85	86	99	54	55	98	WRS	0.038	N/A	YES

Notes:

a TP= test of proportions (implemented using the Fisher exact test)
WRS= Wilcoxon rank sum test
WRS(G)= Gehan-Wilcoxon test
H_0 is that site ≤ ambient

b Calculated significance level for individual statistical tests. Reject H_0 if Prob ≤ 0.05.

c Conducted in cases where the WRS/WRS(G) test cannot be performed, or when H_0 is not rejected by these tests

> Greater than

≤ Less than or equal to

bgs Below ground surface

H_0 Null hypothesis

N/A Not applicable, H_0 was rejected based on either the WRS or WRS(G) test .

1 The conclusion that the site exceeds ambient is based only on the comparison of detection frequencies, rather than the magnitude of chemical concentrations.

2 The quantile test could not be run because at least one of the largest r measurements was a censored value.

TABLE E-10: SOIL BACKGROUND COMPARISON

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

Chemical	OU-2B Site 4 Soil (0-8 feet bgs) Sample Size Detected	Sample Size Total	Detection Frequency	Alameda Ambient (Pink) Sample Size Detected	Sample Size Total	Detection Frequency	1st Tier Statistical Test[a] Test	Prob[b]	Quantile Test Conclusion (Tier 2)$_c$	Site > Ambient? (YES or NO)
Aluminum	36	37	97	55	55	100	WRS	<0.001	N/A	YES
Antimony	5	39	13	18	55	33	TP	1.000	(2)	NO
Arsenic	31	37	84	45	55	82	WRS(G)	0.002	N/A	YES
Barium	36	37	97	55	55	100	WRS	0.001	N/A	YES
Beryllium	23	39	59	28	55	51	TP	0.031	(2)	YES (1)
Cadmium	10	39	26	11	55	20	TP	0.487	(2)	NO
Calcium	36	37	97	55	55	100	WRS	0.003	N/A	YES
Chromium	37	39	95	55	55	100	WRS(G)	0.253	Site ≤ Ambient	NO
Cobalt	36	37	97	48	55	87	WRS(G)	<0.001	N/A	YES
Copper	37	39	95	52	55	95	WRS(G)	<0.001	N/A	YES
Iron	36	37	97	55	55	100	WRS	<0.001	N/A	YES
Lead	34	39	87	51	55	93	WRS(G)	0.002	N/A	YES
Magnesium	36	37	97	55	55	100	WRS	<0.001	N/A	YES
Manganese	36	37	97	55	55	100	WRS	<0.001	N/A	YES
Mercury	6	39	15	7	54	13	TP	0.497	(2)	NO
Molybdenum	2	31	6	0	16	0	TP	1.000	(2)	NO
Nickel	38	39	97	55	55	100	WRS	0.028	N/A	YES
Potassium	34	37	92	55	55	100	WRS(G)	0.301	Site ≤ Ambient	NO
Selenium	1	37	3	0	55	0	TP	1.000	(2)	NO
Silver	4	39	10	11	55	20	TP	0.660	(2)	NO
Sodium	29	37	78	54	55	98	WRS(G)	0.998	Site ≤ Ambient	NO
Thallium	8	37	22	0	55	0	TP	1.000	(2)	NO
Vanadium	36	37	97	55	55	100	WRS	<0.001	N/A	YES
Zinc	38	39	97	54	55	98	WRS	<0.001	N/A	YES

Notes:

a	TP= test of proportions (implemented using the Fisher exact test) WRS= Wilcoxon rank sum test WRS(G)= Gehan-Wilcoxon test H_0 is that site ≤ ambient
b	Calculated significance level for individual statistical tests. Reject H_0 if Prob ≤ 0.05.
c	Conducted in cases where the WRS/WRS(G) test cannot be performed, or when H_0 is not rejected by these tests
>	Greater than
<	Less than or equal to
bgs	Below ground surface
H0	Null hypothesis
N/A	Not applicable, H_0 was rejected based on either the WRS or WRS(G) test .
1	The conclusion that the site exceeds ambient is based only on the comparison of detection frequencies, rather than the magnitude of chemical concentrations.
2	The quantile test could not be run because at least one of the largest r measurements was a censored value.

TABLE E-11: GROUNDWATER BACKGROUND COMPARISON

Appendix E, OU-2B Remedial Investigation Report, Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

	OU-2B Groundwater			Alameda Ambient Groundwater			1st Tier Statistical Test[a]		Quantile Test	Site > Ambient?
	Sample Size		Detection	Sample Size		Detection				
Chemical	Detected	Total	Frequency	Detected	Total	Frequency	Test	Prob[b]	Conclusion (Tier 2)$_c$	(YES or NO)
Aluminum	28	59	47	56	194	29	TP	0.660	Site ≤ Ambient	NO
Antimony	29	62	47	13	194	7	TP	0.426	(2)	NO
Arsenic	45	63	71	107	198	54	TP	1.000	(2)	NO
Barium	55	59	93	161	194	83	WRS(G)	<0.001	N/A	YES
Beryllium	6	59	10	18	194	9	TP	1.000	(2)	NO
Cadmium	16	69	23	22	194	11	TP	0.262	(2)	NO
Calcium	63	63	100	194	198	98	WRS(G)	0.002	N/A	YES
Chromium	30	68	44	33	194	17	TP	0.004	Site > Ambient	YES
Chromium(VI)	6	18	33	1	7	14	TP	0.161	(2)	NO
Cobalt	46	59	78	12	194	6	TP	0.003	Site > Ambient	YES
Copper	46	61	75	60	194	31	TP	0.239	(2)	NO
Iron	51	63	81	130	198	66	WRS(G)	0.015	N/A	YES
Lead	22	82	27	17	195	9	TP	0.028	(2)	YES (1)
Magnesium	62	63	98	198	198	100	WRS	0.024	N/A	YES
Manganese	61	63	97	187	198	94	WRS(G)	0.004	N/A	YES
Mercury	2	63	3	4	198	2	TP	1.000	(2)	NO
Molybdenum	39	54	72	12	119	10	TP	<0.001	(2)	YES (1)
Nickel	52	65	80	23	198	12	TP	<0.001	Site > Ambient	YES
Potassium	63	63	100	193	198	97	WRS(G)	0.441	Site > Ambient	YES
Selenium	26	56	46	1	193	1	TP	0.225	(2)	NO
Silver	4	61	7	4	188	2	TP	0.245	(2)	NO
Sodium	63	63	100	198	198	100	WRS	0.055	Site > Ambient	YES
Thallium	5	61	8	3	193	2	TP	1.000	(2)	NO
Vanadium	40	63	63	72	198	36	TP	0.604	Site ≤ Ambient	NO
Zinc	37	63	59	65	198	33	TP	0.180	Site> Ambient	NO

Notes:

a TP= test of proportions (implemented using the Fisher exact test)
WRS= Wilcoxon rank sum test
WRS(G)= Gehan-Wilcoxon test
H_0 is that site ≤ ambient

b Calculated significance level for individual statistical tests. Reject H_0 if Prob ≤ 0.05.

c Conducted in cases where the WRS/WRS(G) test cannot be performed, or when H_0 is not rejected by these tests

> Greater than

≤ Less than or equal to

H_0 Null hypothesis

N/A Not applicable, H_0 was rejected based on either the WRS or WRS(G) test .

1 The conclusion that the site exceeds ambient is based only on the comparison of detection frequencies, rather than the magnitude of chemical concentrations.

2 The quantile test could not be run because at least one of the largest r measurements was a censored value.

ATTACHMENT A
SAMPLES FOR USE AS BACKGROUND, NAVAL AIR STATION, ALAMEDA, ALAMEDA, CALIFORNIA.

PRC Environmental Management, Inc.
1099 18th Street
Suite 1960
Denver, CO 80202
303-295-1101
Fax 303-295-2818

PRC

February 7, 1997

Ms. Teresa Bernhard/Ms. Camille Garibaldi
Engineers-in-Charge
Department of the Navy
Engineering Field Activity West
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066-5006

CLEAN Contract Number N62474-88-D-5086
Contract Task Order 0316

Subject: Samples for Use as Background, Naval Air Station (NAS) Alameda, Alameda, California

Dear Ms. Bernhard and Ms. Garibaldi:

PRC Environmental Management Inc. (PRC) has completed its review of the NAS Alameda Remedial Investigation (RI) database and has selected samples that could be used to provide background information for the installation. The samples were selected to represent the three distinct fill areas previously identified from the RI data. A preliminary list of samples and accompanying map were provided to you on November 27, 1996. The list (Table 1) and map (Plate 1) are now revised and are enclosed herein. Additional samples have been included in this deliverable; a description of the selection criteria is also included in this letter. A data summary table for inorganic and polycyclic aromatic hydrocarbon (PAH) analytes and cumulative plots for all inorganic analytes are also provided. Additionally, this letter report describes the basis for establishing background as well as applicable guidance from several regulatory agencies regarding definition of background, and methods for evaluating data. This report is organized into the following sections: Purpose, Project History, and Background Data Set Selection. References are provided at the end of the letter; tables and figures follow the letter. Attachment A includes graphical presentations of the data for each fill area.

Purpose

Background information is typically collected and analyzed iteratively as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. In a site investigation, determining if a release has occurred requires that information regarding background conditions be available. Data must be obtained to determine "whether site concentrations are sufficiently different from background" (EPA 1990). The determination of background conditions is an integral part of the baseline human health risk assessment (HHRA) and ecological risk assessment, which are conducted as part of the RI to ensure protection of human health and the environment — one of the two threshold criteria of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Risk Assessment Guidance for Superfund, Human Health Evaluation Manual (Volume I) (EPA 1989) presents a discussion of

hypothesis testing and levels of precision of statistical tests that should be met when differentiating background from site-related chemicals.

California Department of Toxic Substances Control (DTSC) guidance (1994) also presents a similar rationale for collecting background samples (emphasis not added):

> Background samples are collected to distinguish between site-related contamination and naturally occurring or anthropogenic contaminant levels. In general, the use of regional background levels for comparison to site contamination is not acceptable. Background samples should be collected for each medium being investigated, be it water, soil, soil gas, or air. Background samples should be collected at or near the site but not in areas likely to be influenced by the contamination and/or facility operations (past or present).

The establishment of background data set is also important for site remediation. CERCLA Section 104(3)(a) specifically states: "The President shall not provide for a removal or remedial action under this section in response to a release or threat of a release of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found." It is important, however, to distinguish between background chemicals and site-related chemicals due to the limitations on action as defined by CERCLA, and because remediation levels for background and ambient chemicals must be established for chemicals which may have an ambient level. It is important, therefore, to distinguish between background chemicals and site-related chemicals due to the limitations on action as defined by CERCLA, and because remediation levels for background and ambient chemicals must be established for chemicals which may have an ambient level.

The definition of background is also important to this discussion. According to the U.S. Environmental Protection Agency (EPA) (1989), background chemicals can be categorized as either:

> Nonanthropogenic or naturally occurring: minerals or other substances present in the environment in forms that have not been influenced by human activities; and
>
> Anthropogenic: natural and manmade substances present in the environment as a result of human activities not specifically related to site activities.

Nonanthropogenic chemicals are naturally occurring organic or inorganic chemicals that are in soil or water as part of the geological or hydrogeological conditions of the area and are in an unaltered form not related to human activity (for example, metals from rock formations or PAHs from forest fires). Anthropogenic background chemicals are related to human activity in the region but are unrelated to site operations; PAHs and metals may be considered anthropogenic background because they are also from sources such as car exhaust.

Inorganic Chemicals

The purpose of identifying background levels of inorganic chemicals is to distinguish between those levels that represent natural soil constituents and those related to site activities. This is a commonly accepted practice, as described in many EPA guidance documents (EPA 1989, EPA 1990). Inorganic chemicals

present as part of the natural soil composition are considered nonanthropogenic. Concentrations of inorganic chemicals may also be affected by non-site related anthropogenic activities. It was expected that concentrations of inorganic chemicals from background samples at NAS Alameda would reflect naturally occurring, ambient levels consistent with concentrations found in bay sediment, which is the source of fill soil at NAS Alameda.

Organic Chemicals (PAHs)

The Navy considers the random detections of PAHs in fill (also called polynuclear aromatic hydrocarbons or PNAs) at many areas of NAS Alameda to be anthropogenic background for two reasons. First, as described in the following section, NAS Alameda is constructed of fill dredged from the San Francisco Bay. The systematic detections of PAHs at the fill soil-native material interface at most IRP sites is evidence that the bay floor was contaminated with PAHs prior to base construction (PRC 1992). The Regional Water Quality Control Board (RWQCB) lists a total ambient level of PAHs in San Francisco Bay sediment of 5.13 milligrams per kilogram (mg/kg) (RWQCB 1996); PAHs detected at or below this concentration are likely to represent the ambient bay levels because the base is constructed of bay sediment. Second, due to its urban location, soil is expected to contain an ambient level of PAHs. For example, the Agency for Toxic Substances and Disease Control (1995) published background soil concentrations of PAHs in urban areas. The ranges are presented on a chemical-specific basis (rather than total) and are as high as 62 mg/kg for heavy molecular weight PAHs and 166 mg/kg for light molecular weight PAHs. DTSC has also recognized background levels of PAHs in the San Francisco Bay area of at least 8.5 mg/kg. As described in correspondence between DTSC and Ecology and Environment, Inc. (1993): At DTSC's request, and to put the remedial goal in perspective, background levels of PNAs were evaluated. PNAs are present in urban environments due to vehicle exhaust, asphalt paving, tobacco and barbecue smoke, and other sources. PNAs were detected in 17 out of 19 of the background samples taken as part of the RI; the level of total PNAs measured in the area near the site ranged from 0.02 to 1.03 mg/kg. The level of PNAs has also been recently measured in 98 background surface soil samples throughout northern California for 17 Preliminary Endangerment Assessments recently submitted to the Cal-EPA and presented in the Draft PHEE [Public Health and Environmental Evaluation]. Analytical data compiled and analyzed from these reports indicate a mean background concentration of total PNAs of 8.5 mg/kg for the 17 sites.

DTSC also accepted background levels of PAHs at the PG&E Martin Service Center (MSC) (1992):

> Background concentrations of total PNAs in soil from parks and along roadsides in the MSC site vicinity ranged from less than the analytical detection limits to 0.11 milligrams per kilogram (mg/kg). This falls within the range reported in the literature for other urban areas of 0.04 to 13 mg/kg (Edwards, 1983).

With these definitions and expected uses of background data, the RI database of NAS Alameda was reviewed to select appropriate background samples since background samples had not been previously collected for the installation. However, samples had been collected in and around the Installation Restoration Program (IRP) sites as part of the RI investigation, and some were collected at sites that were primarily suspected of containing petroleum contamination. Samples from these areas were considered potential background data, in accordance with DTSC recommendations for identifying background (DTSC 1995):

The largest data set possible is desirable for describing ambient conditions. If the number of 'background' samples planned is not sufficiently large, the population size for 'background' analysis can be expanded by a technique used successfully at several other sites. Samples of soil collected because of suspected contamination with petroleum products often are found negative for these mixtures upon assay. If these same samples were analyzed for metals, the basewide data set can be augmented.

Accordingly, samples in the IRP data set were evaluated for use as background samples, and both metals and PAHs were considered as having a background level.

Background Project History

Selection of background data at NAS Alameda is complicated by the fact that the installation is constructed of fill soil. Although the exact sources of fill are unknown, it was dredged from San Francisco Bay over a period of approximately 75 years (1900 to 1975). The lithology of the fill soil is not classifiable, as it is heterogeneous throughout the base. At the southeastern corner of the base, approximately 3 feet of soil overlay the native Merritt Sand. In the rest of the installation, fill soil represents the top 10 to 14 feet of soil; soil below these depths represents the bay floor material as it existed prior to placement of fill. It is difficult to establish background for fill soil because the exact sources are unknown.

In a previous letter to the regulatory agencies (dated October 11, 1996), the identification of the different fill areas across the base has been described. Briefly, the base was examined by aggregating data collected within areas delineated by time of fill deposition. Five fill areas were first identified: the far west portion of the base ("Site 1/Site 2" area) and a small strip of land bordering the Oakland Inner Harbor; the runway area; the area east of the runway to the base boundary; and two areas within the southeast corner of the base. Iron and manganese data were compared statistically to determine whether these areas contained geologically similar soils and could be represented by one background data set. The reasons for using iron and manganese for this evaluation and the methodology employed (described in the letter of October 11, 1996) are:

- Both iron and manganese are common soil components
- Based on site history, neither chemical is related to any site activity at NAS Alameda
- Both chemicals are present at quantities well above detection limits at all sites (that is, they have 100 percent frequencies of detection), eliminating the potential problem of differing detection limits between sampling efforts at NAS Alameda. (Multiple detection limits can be a confounding factor in the interpretation of results.)
- U.S. Environmental Protection Agency (EPA)-established analytical methods for these two analytes have not changed between sampling efforts at NAS Alameda.

- The distributions of iron and manganese oxides have been shown to affect the concentration of many other chemicals in soil (Evans 1989; Jenne 1968)

Using nonparametric statistical tests, results of the evaluation indicated that some areas could be combined, but that more than one data set would be needed to represent background for the entire installation. Specifically, it appeared that Site 1 and Site 2 areas were similar; the runway and central portion of the installation were similar; and the two areas at the southeast corner of the base were similar. (These areas are denoted on Figure 1 by the colors blue, pink, and yellow.) Therefore, three background data sets are indicated to accurately conduct statistical evaluations for the purpose of selecting chemicals of concern (COCs) and establishing remediation levels, if necessary.

Environmental Baseline Survey (EBS) data were not included in the evaluation of the fill area soil types. Although this data had at one point been considered potential background data, it was eventually excluded from the evaluation because of data quality issues and concerns about the whether the data from the RI and EBS sampling efforts could be combined. The issues could not be resolved and the EBS data was not used. The EBS data had been collected for a different assessment purpose and data quality objectives for EBS data had not included use as potential background data, which requires a more stringent collection and validation process than has been planned for the EBS data.

Background Data Selection

Some samples collected as part of the IRP investigation could be used as background samples for the three areas. Use of this data would avoid costly delays associated with additional sampling and so was considered the most efficient method for developing a background data set. The RI database was reviewed on a sample-by-sample basis to select samples that could represent background. First, for each area, all samples collected from IRP sites that could contain metal contamination based on site history (Sites 4 and 5) were excluded as background samples. Also excluded from consideration were areas of suspected PAH contamination, specifically, the landfill and burn pit areas of Site 1.

Next, samples from borings that contained non-PAH organic chemicals, except for insignificant levels of laboratory contaminants and organic carbon measurements, were excluded from consideration. Common laboratory contaminants, according to EPA, are acetone, 2-butanone (methyl ethyl ketone), methylene chloride, toluene, and phthalate ethers (EPA 1989). This consideration was necessary because older data collected by Canonie had not been validated as thoroughly as data collected after 1990 and there was an indication of low level laboratory contamination which occurred sporadically in these data.

This process resulted in many samples being rejected as potential background data. After applying these steps, samples located within the IRP sites were excluded as well. The remaining samples were considered to be potential background data.

In the three fill areas identified (denoted by the colors blue, pink, and yellow on the attached plate), a total of 247 samples have been selected as potential background samples. Table 1 lists the sample identification numbers and depth interval for each sample selected. As shown in Plate 1 and Tables 2 through 4, 140 samples were identified in the blue area, 56 samples in the pink area, and 51 samples in the yellow area.

Samples in the blue area were not consistently analyzed for both metals and PAHs: 34 were analyzed for both, while 55 were analyzed only for metals and 51 only for semivolatile organic compounds (including PAHs). The samples are indicated on Plate 1 by point name, rather than sample name, because often samples were collected at multiple depths within a borehole.

Tables 2 through 4 provide data summaries for the data sets, including maximum, minimum, and average values, as well as the probability density function for each chemical. Sample quantitation limits, frequencies of detection, and standard deviations are also presented. Cumulative frequency plots for each chemical in each area are included as an attachment to this letter. The plots include all detected results and, for chemicals with less than 100 percent frequency of detection, detected results and nondetected results set equal to one-half the sample quantitation limit. Probability density functions (PDFs) were determined from detected results only. This information allows for comparison of the data selected to regional values and among the three fill areas identified at NAS Alameda. The ranges of chemical concentrations are specific to each of the three fill areas, as shown below for select chemicals (in milligrams per kilogram):

	Blue	Pink	Yellow
Arsenic	0.74 - 23.0	0.44 - 15.6	1.1 - 33.0
Beryllium	0.09 - 0.77	0.25 - 2.3	0.3 - 1.3
Chromium	11.4 - 81.7	12.3 - 66.7	5.0-69.7
Iron	760 - 26, 900	4,500-27,900	10 - 20,800
Manganese	50 - 1,060	55.5-885	5.0-330
Nickel	11.6 - 88.5	11.5 - 80.4	5.0 - 71.1
Benzo(a) pyrene	0.048 - 1.3	2.6	0.024
Chrysene	0.058 - 1.3	1.5	0.022 - 0.13

The cumulative frequency plots are provided in Attachment A, as well as coefficients of variation (standard deviation divided by the mean). These are provided on the plots in Attachment A. Overall, the coefficients of variation (also presented in Tables 2 through 4) are below 1.0. When nondetects are excluded from the data set and only detected results are plotted, the cumulative frequency graphs are relatively straight for those chemicals with lower frequencies of detection. The plots have elsewhere been used to establish a single background value for each analyte, which were subsequently used to select COCs. This value could be selected from the lower portion of a cumulative frequency plot, assuming that a "hinge point" exists to demarcate site contamination from background levels (according to a letter from DTSC to Navy dated September 29, 1995). As described by Gilbert (1996), this "definition of ambient background is predicated on the idea that testing for compliance with a background standard should be done by comparing the highest measurement from a PCA [potentially contaminated area] with a single background number (threshold). That is, the background data set should be reduced to a single number for testing purposes." He concludes that the hinge point approach is not technically defensible for at least two reasons. First, "the Type I decision error rate (probability that the analyte will be incorrectly declared a COPC [chemical of potential concern]) depends critically on the number of measurements from the PCA" (Gilbert 1996). As he describes, the hinge point method has the potential for generating extremely low background threshold levels, which will in turn result in many false positive decision errors. That is, the probability of incorrectly deciding that the analyte is a COPC becomes very high, if not certain.

Second, the hinge point method "does not make full use of the information about variability of the background measurements.... The existence of a hinge point does not necessarily mean that two populations are present and that the lower portion of the plot (nearest the origin) is the ambient background distribution....However, the more fundamental point is that, as pointed out above, the practice of reducing the background population to a single threshold value is not a technically defensible method for determining if an analyte is a COPC. "

Gilbert presents a detailed discussion of this in his letter to the Navy (1996) and in Hardin and Gilbert (1993). Therefore, while these plots provide a visual inspection of the data, they will not be used to determine a background data set or one value to represent "background." The data presented here constitute the background ranges and data that will be used to statistically determine which chemicals are above or below background levels for each site using the methodology in Navy policy.

In conclusion, the data presented here represent the background data and ranges (presented in Tables 2 through 4) for the three fill areas of NAS Alameda. The number of samples and areal distribution of samples within each of the three fill areas meets concerns of sufficient statistical power, confidence, and spatial representation of the data. The background ranges can be used to conduct statistical tests of means to select COCs. Please call me at (303) 312-8843 if you have any questions or comments regarding this deliverable.

Sincerely,

Theresa K. Lopez

Theresa K. Lopez
Senior Toxicologist

cc: Susan Willoughby, PRC
Duane Balch, PRC

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TABLE 1

NAS ALAMEDA
SAMPLES SELECTED FOR BACKGROUND DATA SET

AREA	SAMPLE	DEPTH INTERVAL (FEET BGS)		POINT NAME
BLUE	280-S09-001	1.5	2.5	M09-05
BLUE	280-S09-002	3.0	4.0	M09-05
BLUE	280-S09-003	5.0	6.0	M09-05
BLUE	280-S16-018	0.5	1.5	B16-10
BLUE	280-S16-019	2.5	3.5	B16-10
BLUE	280-S16-020	3.5	4.5	B16-10
BLUE	280-S16-021	5.0	6.0	B16-10
BLUE	280-S16-022	1.5	2.5	B16-11
BLUE	280-S16-023	2.5	3.5	B16-11
BLUE	280-S16-024	5.0	6.0	B16-11
BLUE	280-S16-025	0.5	1.5	B16-12
BLUE	280-S16-026	2.5	3.5	B16-12
BLUE	280-S16-027	5.0	6.0	B16-12
BLUE	280-S16-028	1.0	2.0	M16-04
BLUE	280-S16-029	2.0	3.0	M16-04
BLUE	280-S7C-001	0.5	1.5	B07C-11
BLUE	280-S7C-002	2.5	3.5	B07C-11
BLUE	280-S7C-003	5.0	6.0	B07C-11
BLUE	280-S7C-004	0.5	1.5	B07C-12
BLUE	B410-7 [1.0-1.5]	1.0	1.5	B410-7
BLUE	B410-7 [3.0-3.5]	3.0	3.5	B410-7
BLUE	B410-7 [5.5-6.0]	5.5	6.0	B410-7
BLUE	B410-7 [6.0-6.5]	6.0	6.5	B410-7
BLUE	B410-7 [8.5-9.0]	8.5	9.0	B410-7
BLUE	B410-7 [9.0-9.5]	9.0	9.5	B410-7
BLUE	B410-7 [11.0-11.5]	11.0	11.5	B410-7
BLUE	B410-7 [11.5-12.0]	11.5	12.0	B410-7
BLUE	B410-7 [14.5-15.0]	14.5	15.0	B410-7
BLUE	B410-7 [15.0-15.5]	15.0	15.5	B410-7
BLUE	B410-9 [1.0-1.5]	1.0	1.5	B410-9
BLUE	B410-9 [2.5-3.0]	2.5	3.0	B410-9
BLUE	B410-9 [3.0-3.5]	3.0	3.5	B410-9
BLUE	B410-9 [5.5-6.0]	5.5	6.0	B410-9
BLUE	B410-9 [6.0-6.5]	6.0	6.5	B410-9
BLUE	B410-9 [8.5 -9.0]	8.5	9.0	B410-9
BLUE	B410-9 [9.0-9.5]	9.0	9.5	B410-9
BLUE	B410-9 [11.5-12.0]	11.5	12.0	B410-9
BLUE	B410-9 [12.0-12.5]	12.0	12.5	B410-9
BLUE	B410-9 [14.5-15.0]	14.5	15.0	B410-9
BLUE	B410-9 [15.0-15.5]	15.0	15.5	B410-9
BLUE	B547-10 [0.5-1.0]	0.5	1.0	B547-10
BLUE	B547-10 [2.0-2.5]	2.0	2.5	B547-10
BLUE	B547-10 [2.5-3.0]	2.5	3.0	B547-10
BLUE	B547-10 [5.0-5.5]	5.0	5.5	B547-10
BLUE	B547-10 [5.5-6.0]	5.5	6.0	B547-10

TABLE 1 (Continued)

NAS ALAMEDA
SAMPLES SELECTED FOR BACKGROUND DATA SET

AREA	SAMPLE	DEPTH INTERVAL (FEET BGS)		POINT NAME
BLUE	B547-10 [8.0-8.5]	8.0	8.5	B547-10
BLUE	B547-10 [8.5-9.0]	8.5	9.0	B547-10
BLUE	B547-10 [11.0-11.5]	11.0	11.5	B547-10
BLUE	B547-10 [11.5-12.0]	11.5	12.0	B547-10
BLUE	B547-10 [14.0-14.5]	14.0	14.5	B547-10
BLUE	B547-10 [14.5-15.0]	14.5	15.0	B547-10
BLUE	B547-6 [2.0-2.5]	2.0	2.5	B547-6
BLUE	B547-6 [2.5-3.0]	2.5	3.0	B547-6
BLUE	B547-6 [3.5-4.0]	3.5	4.0	B547-6
BLUE	B547-6 [4.0-5.0]	4.0	5.0	B547-6
BLUE	B547-6 [5.0-5.5]	5.0	5.5	B547-6
BLUE	B547-6 [6.0-6.5]	6.0	6.5	B547-6
BLUE	B547-6 [6.5-7.0]	6.5	7.0	B547-6
BLUE	B547-6 [9.0-9.5]	9.0	9.5	B547-6
BLUE	B547-6 [9.5-10.0]	9.5	10.0	B547-6
BLUE	B547-6 [11.0-11.5]	11.0	11.5	B547-6
BLUE	B547-6 [11.5-12.0]	11.5	12.0	B547-6
BLUE	B547-6 [14.0-14.5]	14.0	14.5	B547-6
BLUE	B547-6 [14.5-15.0]	14.5	15.0	B547-6
BLUE	BC2-7 [0.5-1.0]	0.5	1.0	BC2-7
BLUE	BC2-7 [2.5-3.0]	2.5	3.0	BC2-7
BLUE	BC2-7 [5.0-5.5]	5.0	5.5	BC2-7
BLUE	BC2-7 [7.0-7.5]	7.0	7.5	BC2-7
BLUE	BC2-7 [9.5-10.0]	9.5	10.0	BC2-7
BLUE	BC2-7 [11.0-11.5]	11.0	11.5	BC2-7
BLUE	BC2-7 [13.5-14.0]	13.5	14.0	BC2-7
BLUE	BC2-7 [14.0-14.5]	14.0	14.5	BC2-7
BLUE	M-BG3-000	0.3	0.5	MBG-3
BLUE	M-BG3-002	2.0	2.5	MBG-3
BLUE	M-BG3-004	4.0	4.5	MBG-3
BLUE	M-BG3-006	5.5	6.0	MBG-3
BLUE	MW410-1 [0.5-1.0]	0.5	1.0	MW410-1
BLUE	MW410-1 [2.0-2.5]	2.0	2.5	MW410-1
BLUE	MW410-1 [3.0-3.5]	3.0	3.5	MW410-1
BLUE	MW410-1 [5.5-6.0]	5.5	6.0	MW410-1
BLUE	MW410-1 [6.5-7.0]	6.5	7.0	MW410-1
BLUE	MW410-1 [7.0-7.5]	7.0	7.5	MW410-1
BLUE	MW410-1 [7.5-8.0]	7.5	8.0	MW410-1
BLUE	MW410-1 [8.0-8.5]	8.0	8.5	MW410-1
BLUE	MW410-1 [11.0-11.5]	11.0	11.5	MW410-1
BLUE	MW410-1 [11.5-12.0]	11.5	12.0	MW410-1
BLUE	MW410-1 [12.5-13.0]	12.5	13.0	MW410-1
BLUE	MW410-1 [14.0-14.5]	14.0	14.5	MW410-1
BLUE	MW410-1 [14.5-15.0]	14.5	15.0	MW410-1
BLUE	MW410-3 [1.0-1.5]	1.0	1.5	MW410-3
BLUE	MW410-3 [3.0-3.5]	3.0	3.5	MW410-3
BLUE	MW410-3 [4.0-4.5]	4.0	4.5	MW410-3
BLUE	MW410-3 [5.5-6.0]	5.5	6.0	MW410-3
BLUE	MW410-3 [6.0-6.5]	6.0	6.5	MW410-3

TABLE 1 (Continued)

NAS ALAMEDA
SAMPLES SELECTED FOR BACKGROUND DATA SET

AREA	SAMPLE	DEPTH INTERVAL (FEET BGS)		POINT NAME
BLUE	MW410-3 [8.5-9.0]	8.5	9.0	MW410-3
BLUE	MW410-3 [9.0-9.5]	9.0	9.5	MW410-3
BLUE	MW410-3 [11.5-12.0]	11.5	12.0	MW410-3
BLUE	MW410-3 [12.0-12.5]	12.0	12.5	MW410-3
BLUE	MW410-3 [14.5-15.0]	14.5	15.0	MW410-3
BLUE	MW410-3 [15.0-15.5]	15.0	15.5	MW410-3
BLUE	MW410-4 [1.0-1.5]	1.0	1.5	MW410-4
BLUE	MW410-4 [3.0-3.5]	3.0	3.5	MW410-4
BLUE	MW410-4 [4.0-4.5]	4.0	4.5	MW410-4
BLUE	MW410-4 [5.5-6.0]	5.5	6.0	MW410-4
BLUE	MW410-4 [6.0-6.5]	6.0	6.5	MW410-4
BLUE	MW410-4 [8.5-9.0]	8.5	9.0	MW410-4
BLUE	MW410-4 [9.0-9.5]	9.0	9.5	MW410-4
BLUE	MW410-4 [11.5-12.0]	11.5	12.0	MW410-4
BLUE	MW410-4 [12.0-12.5]	12.0	12.5	MW410-4
BLUE	MW410-4 [14.5-15.0]	14.5	15.0	MW410-4
BLUE	MW410-4 [15.0-15.5]	15.0	15.5	MW410-4
BLUE	MW547-1 [0.5-1.0]	0.5	1.0	MW547-1
BLUE	MW547-1 [2.0-2.5]	2.0	2.5	MW547-1
BLUE	MW547-1 [2.5-3.0]	2.5	3.0	MW547-1
BLUE	MW547-1 [4.5-5.0]	4.5	5.0	MW547-1
BLUE	MW547-1 [5.0-5.5]	5.0	5.5	MW547-1
BLUE	MW547-1 [8.0-8.5]	8.0	8.5	MW547-1
BLUE	MW547-1 [8.5-9.0]	8.5	9.0	MW547-1
BLUE	MW547-1 [11.0-11.5]	11.0	11.5	MW547-1
BLUE	MW547-1 [11.5-12.0]	11.5	12.0	MW547-1
BLUE	MW547-1 [14.0-14.5]	14.0	14.5	MW547-1
BLUE	MW547-1 [14.5-15]	14.5	15.0	MW547-1
BLUE	MW547-2 [0.5-1.0]	0.5	1.0	MW547-2
BLUE	MW547-2 [2.0-2.5]	2.0	2.5	MW547-2
BLUE	MW547-2 [2.5-3.0]	2.5	3.0	MW547-2
BLUE	MW547-2 [5.0-5.5]	5.0	5.5	MW547-2
BLUE	MW547-2 [5.5-6.0]	5.5	6.0	MW547-2
BLUE	MW547-2 [6.0-6.5]	6.0	6.5	MW547-2
BLUE	MW547-2 [6.5-7.0]	6.5	7.0	MW547-2
BLUE	MW547-2 [9.5-10.0]	9.5	10.0	MW547-2
BLUE	MW547-2 [10.0-10.5]	10.0	10.5	MW547-2
BLUE	MW547-2 [12.5-13.0]	12.5	13.0	MW547-2
BLUE	MW547-2 [13.0-13.5]	13.0	13.5	MW547-2
BLUE	MW547-2 [14.0-14.5]	14.0	14.5	MW547-2
BLUE	MW547-2 [14.5-15.0]	14.5	15.0	MW547-2
BLUE	MWC2-3 [1.0-1.5]	1.0	1.5	MWC2-3
BLUE	MWC2-3 [4.0-4.5]	4.0	4.5	MWC2-3
BLUE	MWC2-3 [5.0-5.5]	5.0	5.5	MWC2-3
BLUE	MWC2-3 [6.5-7.0]	6.5	7.0	MWC2-3
BLUE	MWC2-3 [7.0-7.5]	7.0	7.5	MWC2-3
BLUE	MWC2-3 [8.0-8.5]	8.0	8.5	MWC2-3
BLUE	MWC2-3 [8.5-9.0]	8.5	9.0	MWC2-3
BLUE	MWC2-3 [9.5-10.0]	9.5	10.0	MWC2-3

TABLE 1 (Continued)

NAS ALAMEDA
SAMPLES SELECTED FOR BACKGROUND DATA SET

AREA	SAMPLE	DEPTH INTERVAL (FEET BGS)		POINT NAME
BLUE	MWC2-3 [10.0-10.5]	10.0	10.5	MWC2-3
BLUE	MWC2-3 [11.0-11.5]	11.0	11.5	MWC2-3
BLUE	MWC2-3 [12.5-13.0]	12.5	13.0	MWC2-3
PINK	280-RA-033	0.0	1.5	M112-A
PINK	280-RA-034	2.5	3.5	M112-A
PINK	280-RA-035	5.0	6.0	M112-A
PINK	280-RA-039	0.0	1.0	M114-A
PINK	280-RA-040	2.0	3.0	M114-A
PINK	280-RA-041	3.5	4.5	M114-A
PINK	280-RA-042	0.0	1.5	M115-E
PINK	280-RA-043	2.5	3.5	M115-E
PINK	280-RA-044	5.0	6.0	M115-E
PINK	280-RA-045	0.0	1.5	M116-E
PINK	280-RA-046	2.5	3.5	M116-E
PINK	280-RA-047	5.0	6.0	M116-E
PINK	280-RA-048	0.0	1.5	M117-E
PINK	280-RA-049	2.5	3.5	M117-E
PINK	280-RA-050	5.0	6.0	M117-E
PINK	B06-07-000	0.5	1.0	B06-07
PINK	B06-07-002	2.0	3.3	B06-07
PINK	B06-07-007	6.5	7.5	B06-07
PINK	B06-07-008	8.0	9.5	B06-07
PINK	B06-08-000	1.0	1.5	B06-08
PINK	B06-08-002	2.0	3.0	B06-08
PINK	B07B-02-000	0.5	1.5	B07B-02
PINK	B07B-02-004	3.5	5.0	B07B-02
PINK	B10-04-000	0.5	1.0	B10-04
PINK	B10-04-005	5.0	6.0	B10-04
PINK	B12-08-000	0.5	1.0	B12-08
PINK	B12-08-004	3.5	5.0	B12-08
PINK	B12-08-010	9.5	10.0	B12-08
PINK	F10 [0.0-0.0]	0.0	0.0	F-10
PINK	M-006A-0	2.0	2.5	M006-A
PINK	M-006A-005	3.5	4.5	M006-A
PINK	M-101A-004	2.0	3.5	M101-A
PINK	M-102A-004	2.0	3.3	M102-A
PINK	M-106A-0	0.0	0.0	M106-A
PINK	M-106A-003	2.0	3.0	M106-A
PINK	M-107A-0	0.0	0.0	M107-A
PINK	M-107A-002	0.5	2.0	M107-A
PINK	M-109A-0	0.0	0.0	M109-A
PINK	M-109A-007	5.5	6.3	M109-A
PINK	M-110A-003	1.5	3.0	M110-A
PINK	M-111A-0	0.5	0.0	M111-A
PINK	M-111A-003	2.0	3.5	M111-A
PINK	M-BG1-002	2.0	2.5	MBG-1
PINK	M-BG1-003	3.0	3.5	MBG-1
PINK	M-BG1-004	5.0	5.5	MBG-1

TABLE 1 (Continued)

NAS ALAMEDA
SAMPLES SELECTED FOR BACKGROUND DATA SET

AREA	SAMPLE	DEPTH INTERVAL (FEET BGS)		POINT NAME
PINK	M-BG2-002	2.0	2.5	MBG-2
PINK	M-BG2-005	5.0	5.5	MBG-2
PINK	M-BG4-002	2.0	2.5	MBG-4
PINK	M-BG4-007	7.5	8.0	MBG-4
PINK	M-BG4-010	10.0	10.5	MBG-4
PINK	M103-A	5.0	6.5	M103-A
PINK	M103-B	0.0	0.5	M103-B
PINK	M105-A	5.5	7.0	M105-A
PINK	M105-B	0.0	0.5	M105-B
PINK	M108-A	5.0	6.5	M108-A
PINK	M108-B	0.0	0.5	M108-B
YELLOW	280-S01-016	0.0	0.0	SS1-RA-14
YELLOW	A2 [0.0-0.0]	0.0	0.0	A-2
YELLOW	A3 [0.0-0.0]	0.0	0.0	A-3
YELLOW	A4 [0.0-0.0]	0.0	0.0	A-4
YELLOW	A5 [0.0-0.0]	0.0	0.0	A-5
YELLOW	A6 [0.0-0.0]	0.0	0.0	A-6
YELLOW	A7 [0.0-0.0]	0.0	0.0	A-7
YELLOW	A8 [0.0-0.0]	0.0	0.0	A-8
YELLOW	B2 [0.0-0.0]	0.0	0.0	B-2
YELLOW	B3 [0.0-0.0]	0.0	0.0	B-3
YELLOW	B4 [0.0-0.0]	0.0	0.0	B-4
YELLOW	B5 [0.0-0.0]	0.0	0.0	B-5
YELLOW	B6 [0.0-0.0]	0.0	0.0	B-6
YELLOW	B7 [0.0-0.0]	0.0	0.0	B-7
YELLOW	B8 [0.0-0.0]	0.0	0.0	B-8
YELLOW	F1 [0.0-0.0]	0.0	0.0	F-1
YELLOW	F2 [0.0-0.0]	0.0	0.0	F-2
YELLOW	F3 [0.0-0.0]	0.0	0.0	F-3
YELLOW	F4 [0.0-0.0]	0.0	0.0	F-4
YELLOW	F5 [0.0-0.0]	0.0	0.0	F-5
YELLOW	F6 [0.0-0.0]	0.0	0.0	F-6
YELLOW	F9 [0.0-0.0]	0.0	0.0	F-9
YELLOW	G2 [0.0-0.0]	0.0	0.0	G-2
YELLOW	G3 [0.0-0.0]	0.0	0.0	G-3
YELLOW	G5 [0.0-0.0]	0.0	0.0	G-5
YELLOW	G8 [0.0-0.0]	0.0	0.0	G-8
YELLOW	G9 [0.0-0.0]	0.0	0.0	G-9
YELLOW	H8 [0.0-0.0]	0.0	0.0	H-8
YELLOW	H9 [0.0-0.0]	0.0	0.0	H-9
YELLOW	I7 [0.0-0.0]	0.0	0.0	I-7
YELLOW	I8 [0.0-0.0]	0.0	0.0	I-8
YELLOW	J7 [0.0-0.0	0.0	0.0	J-7
YELLOW	J8 [0.0-0.0]	0.0	0.0	J-8
YELLOW	K6 [0.0-0.0]	0.0	0.0	K-6
YELLOW	K7 [0.0-0.0]	0.0	0.0	K-7
YELLOW	L5 [0.0-0.0]	0.0	0.0	L-5
YELLOW	L6 [0.0-0.0]	0.0	0.0	L-6

TABLE 1 (Continued)

NAS ALAMEDA
SAMPLES SELECTED FOR BACKGROUND DATA SET

AREA	SAMPLE	DEPTH INTERVAL (FEET BGS)		POINT NAME
YELLOW	L7 [0.0-0.0]	0.0	0.0	L-7
YELLOW	M-004A-0	2.0	2.5	M004-A
YELLOW	M-004A-004	3.5	4.5	M004-A
YELLOW	M-005A-0	0.5	1.5	M005-A
YELLOW	M-005A-003	2.0	2.5	M005-A
YELLOW	M-008A-0	0.5	1.8	M008-A
YELLOW	M-008A-004	2.0	3.3	M008-A
YELLOW	M-025A-004	4.0	0.0	M025-A
YELLOW	M4 [0.0-0.0]	0.0	0.0	M-4
YELLOW	M5 [0.0-0.0]	0.0	0.0	M-5
YELLOW	M6 [0.0-0.0]	0.0	0.0	M-6
YELLOW	M7 [0.0-0.0]	0.0	0.0	M-7
YELLOW	M8 [0.0-0.0]	0.0	0.0	M-8

Notes:

bgs = Below ground surface
Point Name designates the sample location as shown on Figure 1.

TABLE 2

NAS ALAMEDA
BACKGROUND DATA FOR BLUE AREA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganic Chemicals (mg/kg)								
Aluminum[2]	NA	89/89	2,880	26,800	5,726	1.6	7,096	0.06
Antimony[3]	0.46-9.2	2/89	0.89	1.0	1.8	1.3	2.1	0.71
Arsenic[2]	0.61-13	34/89	0.74	23.0	2.2	2.9	4.8	1.3
Barium[1]	24-25	86/89	0.30	198	48.9	32.3	55.7	0.66
Beryllium[1]	0.2-1.3	25/89	0.09	0.77	0.32	0.21	0.36	0.67
Cadmium[1]	0.06-1.3	30/89	0.1	0.82	0.32	0.23	0.37	0.73
Calcium[2]	NA	89/89	1,360	19,200	3,044	1.9	4,185	0.08
Chromium[1]	NA	89/89	11.4	81.7	33.7	12.9	36.5	0.38
Cobalt[1]	3.9-6.8	67/89	1.9	14	5.0	2.7	5.6	0.53
Copper[2]	5.8-6.3	84/89	4.2	89.4	10.4	2.0	15.2	0.30
Iron[1]	NA	89/89	760	26,900	10,068	5,070	11,135	0.50
Lead[2]	1.4-6.8	28/89	1.3	41	3.3	2.3	5.4	0.68
Magnesium[2]	NA	89/89	1,510	42,400	2,560	1.6	3,156	0.06
Manganese[2]	NA	89/89	50	1,060	126	1.7	160.0	0.11
Nickel[2]	NA	89/89	11.6	88.5	26.9	1.5	31.9	0.13
Potassium[2]	610	88/89	310	6,382	802	1.6	998	0.07
Selenium[3]	0.39-13	1/89	5.7	5.7	2.8	2.1	3.3	0.75
Silver[3]	0.18-6.5	2/89	0.44	0.61	0.95	1.2	1.2	1.2
Sodium[3]	288-650	69/89	88.1	3,510	299.8	2.2	470.7	0.14
Thallium[3]	0.33-13	1/89	5.3	5.3	2.3	2.2	2.8	0.94
Titanium[1]	NA	66/66	223	1,020	408.4	145.8	444.3	0.36
Vanadium[1]	NA	89/89	12.8	62.3	22.5	8.9	24.3	0.39

TABLE 2 (Continued)

NAS ALAMEDA
BACKGROUND DATA FOR BLUE AREA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Zinc[2]	NA	89/89	14	316	27.0	1.6	33.5	0.15
Polycyclic Aromatic Hydrocarbons (µg/kg)								
Acenaphthene[3]	83-14,000	1/85	130	130	293.1	743.2	453.5	2.5
Anthracene[3]	83-14,000	2/85	59	390	294.2	743.5	454.7	2.5
Benzo(a)anthracene[4]	100-14,000	8/85	61	1,000	290.1	747.9	451.5	2.6
Benzo(a)pyrene[2]	140-14,000	11/85	48	1,300	208.4	1.8	277.3	0.11
Benzo(b)fluoranthene[2]	100-14,000	9/85	66	760	202.4	1.8	273.9	0.11
Benzo(g,h,i)perylene[4]	170-14,000	6/85	140	950	304.6	745.8	465.6	2.4
Benzo(k)fluoranthene[2]	100-14,000	6/85	100	1,100	208.1	1.8	280.9	0.11
Chrysene[4]	100-14,000	11/85	58	1,300	288.9	752.6	451.3	2.6
Dibenzo(a,h)anthracene[3]	170-14,000	1/85	230	230	296.4	742.4	456.7	2.5
Fluoranthene[2]	83-14,000	12/85	54	2,000	198.2	1.9	284.2	0.13
Fluorene[3]	83-14,000	1/85	100	100	292.7	743.3	453.2	2.5
Indeno(1,2,3-cd)pyrene[2]	170-14,000	6/85	120	930	215.2	1.7	279.3	0.10
Naphthalene[3]	83-14,000	1/85	35	35	292.3	743.5	452.8	2.5
Phenanthrene[2]	83-14,000	8/85	27	1,600	196.0	2.0	284.2	0.13
Pyrene[1]	83-14,000	12/85	65	2,500	343.4	785.3	484.6	2.3
2-methylnaphthalene[3]	100-14,000	1/85	320	320	294.2	742.9	454.6	2.5

Notes:

(1) Data normally distributed
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution. Calculated coefficient of variation from arithmetic mean and standard deviation.
(4) Data are not normally or lognormally distributed. Calculated coefficient of variation from arithmetic mean and standard deviation.
NA Not applicable
mg/kg milligrams per kilogram
µg/kg micrograms per kilogram

TABLE 3

NAS ALAMEDA
BACKGROUND DATA FOR YELLOW AREA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganic Chemicals (mg/kg)								
Aluminum[1]	NA	51/51	20.0	13,300	6,156	2,532	6,869	0.41
Antimony[3]	1.3-7.3	3/51	2.8	3.6	2.9	0.69	3.1	0.24
Arsenic[1]	10-12	22/51	1.1	33	7.6	6.4	9.4	0.84
Barium[2]	21-24	44/51	19.8	260	30.4	1.9	43.5	0.18
Beryllium[1]	1-1.2	10/51	0.3	1.3	0.58	0.19	0.63	0.33
Cadmium[1]	0.36-1.2	12/51	0.33	2.9	0.66	0.49	0.80	0.74
Calcium[2]	NA	51/51	500	97,000	3,441	2.0	5,269	0.08
Chromium[4]	NA	51/51	5.0	69.7	32.1	8.4	34.4	0.26
Cobalt[1]	5-7.6	20/51	4.3	11.4	4.3	2.3	4.9	0.53
Copper[1]	5.5-5.6	49/51	4.2	49	15.9	12.0	19.3	0.76
Iron[1]	NA	51/51	10.0	20,800	10,324	3,859	11,410	0.37
Lead[3]	NA	51/51	3.3	752	22.2	2.8	51.7	0.33
Magnesium[2]	NA	51/51	500	8,820	2,541	1.6	3,178	0.06
Manganese[1]	NA	51/51	5.0	330	136.9	73.6	157.6	0.54
Mercury[1]	0.05-0.15	5/10	0.05	0.18	0.08	0.05	0.12	0.68
Nickel[4]	NA	51/51	5.0	71.1	27.8	9.8	30.6	0.35
Potassium[1]	NA	51/51	500	1,700	921	291	1,003	0.32
Silver[4]	0.18-6	6/51	0.52	30	2.9	4.1	4.0	1.4
Sodium[1]	125-610	11/51	232	1,380	353	260.8	425.9	0.74
Titanium[1]	NA	41/41	280	663	456	77.1	480.2	0.17
Vanadium[1]	NA	51/51	15.6	50.0	25.7	7.9	27.9	0.31
Zinc[1]	NA	51/51	17.0	140.0	47.8	31.9	56.8	0.67

TABLE 3 (Continued)

NAS ALAMEDA
BACKGROUND DATA FOR YELLOW AREA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Polycyclic Aromatic Hydrocarbons (µg/kg)								
Benzo(a)pyrene(3)	84-,6,700	1/51	24.0	24.0	400.4	487.1	537.4	1.2
Benzo(g,h,i)perylene(3)	96-6,700	1/51	19.0	19.0	402.2	485.9	538.9	1.2
Chrysene(3)	60-6,700	2/51	22.0	130.0	398.2	488.7	535.6	1.2
Fluoranthene(3)	48-6,700	3/51	30.0	790.0	407.0	492.1	545.4	1.2
Indeno(1,2,3-cd)pyrene(3)	96-6,700	1/51	21.0	21.0	402.2	485.9	538.9	1.2
Phenanthrene(3)	48-6,700	2/51	120.0	200.0	401.9	486.7	538.8	1.2
Pyrene(3)	48-6,700	4/51	33.0	900.0	411.1	492.8	549.7	1.2

Notes:

(1) Data normally distributed
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution
(4) Data are not normally or lognormally distributed
NA Not applicable
mg/kg milligrams per kilogram
µg/kg micrograms per kilogram

TABLE 4

NAS ALAMEDA
BACKGROUND DATA FOR PINK AREA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Inorganic Chemicals (mg/kg)								
Aluminum[2]	NA	56/56	1,700	22,600	5304.7	1.6	6,657.7	0.05
Antimony[1]	0.46-11.0	19/56	0.7	8.6	2.3	1.9	2.8	0.83
Arsenic[2]	0.59-10.0	46/56	0.44	15.6	1.8	2.3	3.2	1.4
Barium[2]	NA	56/56	6.9	156.0	36.6	1.7	48.7	0.15
Beryllium[1]	0.15-1.0	29/56	0.25	2.3	0.53	0.43	0.64	0.81
Cadmium[2]	0.08-1.0	11/56	0.1	3.2	0.18	2.7	0.42	0.58
Calcium[2]	NA	56/56	816.0	66,600.0	2,962.6	2.1	4,785.2	0.09
Chromium[1]	NA	56/56	12.3	66.7	30.1	10.1	32.8	0.34
Cobalt[4]	3.96-5.7	49/56	3.0	62.1	7.1	10.0	9.8	1.4
Copper[2]	8.8-10.2	53/56	3.1	49.1	7.6	1.8	10.5	0.29
Iron[2]	NA	56/56	4,500.0	27,900.0	9,543.0	1.5	11,604.9	0.05
Lead[2]	1.9-3.0	52/56	0.47	165.0	4.3	2.9	10.4	0.73
Magnesium[2]	NA	56/56	1,290.0	8,800.0	2,646.9	1.5	3,195.9	0.05
Manganese[2]	NA	56/56	55.5	885.0	130.6	1.8	181.7	0.12
Mercury[2]	0.06-0.269	8/56	0.057	2.71	0.064	2.4	0.12	0.32
Nickel[2]	NA	56/56	11.5	80.4	25.6	1.4	29.9	0.10
Potassium[2]	NA	56/56	209.0	2,480.0	696.3	1.5	847.9	0.07
Silver[2]	0.18-1.47	12/56	0.32	5.6	0.32	2.5	0.63	0.80
Sodium[2]	NA	56/56	62.6	1,580.0	337.3	1.9	503.1	0.11
Thallium[4]	0.11-10.0	1/56	0.53	0.53	0.25	0.65	0.43	0.34
Titanium[3]	NA	1/1	518.0	518.0	518.0	NA	NA	NA
Vanadium[1]	NA	56/56	10.5	55.3	22.9	9.2	25.4	0.40

TABLE 4 (Continued)

NAS ALAMEDA
BACKGROUND DATA FOR PINK AREA
DATA SUMMARY

Chemical	Sample Quantitation Limit	Frequency of Detection	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	95 Percent Upper Confidence Limit Concentration	Coefficient of Variation
Zinc[1]	18.0	55/56	10.0	1910.0	23.2	1.7	30.8	0.17
Polycyclic Aromatic Hydrocarbons (:g/kg)								
Acenaphthene[3]	70-3,400	1/56	150.0	150.0	121.6	226.2	182.3	1.9
Anthracene[3]	70-3,400	1/56	240.0	240.0	123.2	226.8	184.1	1.8
Benzo(a)anthracene[3]	100-3,400	1/56	1,600.0	1,600.0	497.1	2,264.3	1,105.0	4.6
Benzo(a)pyrene[3]	140-3,400	1/56	2,600.0	2,600.0	186.4	394.9	292.4	2.1
Benzo(b)fluoranthene[3]	100-3,400	1/56	2,300.0	2,300.0	168.1	366.1	266.4	2.2
Benzo(g,h,i)perylene[3]	160-3,400	1/56	1,700.0	1,700.0	177.1	300.4	257.7	1.7
Benzo(k)fluoranthene[3]	100-3,400	1/56	620.0	620.0	138.1	232.9	200.6	1.7
Chrysene[3]	100-3,400	1/56	1,500.0	1,500.0	153.8	288.9	231.4	1.9
Fluoranthene[3]	70-3,400	3/56	34.0	3,600.0	207.5	477.0	355.6	2.3
Indeno(1,2,3-cd)pyrene[3]	160-3,400	1/56	1,800.00	1,800.00	178.8	309.8	262.0	1.7
Naphthalene[3]	70-3,400	1/56	99.0	99.0	120.7	226.2	181.4	1.9
Phenanthrene[3]	70-3,400	2/56	240.0	2,200.0	131.3	291.1	209.4	2.2
Pyrene[3]	70-3,400	3/56	210.0	6,100.0	240.5	831.0	463.5	3.5

Notes:

(1) Data normally distributed
(2) Data lognormally distributed. Calculated coefficient of variation for natural logarithm-transformed data.
(3) Too few detections to determine distribution. Calculated coefficient of variation from arithmetic mean and standard deviation.
(4) Data are not normally or lognormally distributed. Calculated coefficient of variation from arithmetic mean and standard deviation.
NA Not applicable
mg/kg milligrams per kilogram
µg/kg micrograms per kilogram

TerraNext 165 South Union Boulevard Union Tower, Suite 1000 Lakewood, CO 80228

Ms. Teresa Bernhard/ Ms. Camille Garibaldi
Engineers-in-Charge
Department of the Navy
Engineering Field Activity West
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066-5006

Dear Ms. Bernhard and Ms. Garibaldi:

This letter contains the results of additional analyses performed on the background data sets as requested at the interagency meeting of February 26, 1997. Specifically, outlier tests were performed for the following chemicals: zinc in the blue area; beryllium in the pink area; and arsenic and silver in the yellow area. Tables presenting the calculations and results of these tests are enclosed as Attachment A. Also, the 80th lower confidence limit on the 95th percentile of the distribution (80LCL/95) value was calculated for all inorganic chemicals at each of the three background areas, and new data summaries calculated without outlying values are included as Tables 1 through 3 of this letter; the 80LCL/95 concentrations are also reported in these data summary tables.

The outlier tests used for evaluating zinc, beryllium, arsenic, and silver were Rosner's test (for zinc and beryllium) and Dixon's test (for arsenic and silver). The Rosner's test requires at least 25 detected results for application, while Dixon's test is more appropriate for sets with less than 25 detected results. The Rosner's test calculates a test value using the mean and standard deviation of the data set after removal of the suspected outlier. The calculated test value is then compared to a critical value corresponding to a particular level of significance and sample. The Dixon's test examines the suspected outlying value relative to the range of values and the next closest value to the suspected outlier. The test value calculated in a Dixon's test is also compared to a critical value corresponding to a desired level of significance and the sample size. In both cases, if the test value exceeds the critical value, the extreme value is considered an outlier. The test are repeated, iteratively removing the most extreme value, until the test value no longer exceeds the critical value. Both of these tests are described in detail in EPA's Guidance for Data Quality Assessment (EPA 1996) and either may be used with normally or lognormally distributed data.

Using these test, it appears that the arsenic value of 33 milligrams per kilogram (mg/kg) in the yellow area is not an outlier. The highest value of zinc (316 mg/kg) in the blue area and of beryllium in the pink area (2.29 mg/kg) are outliers at alpha = 0.05. The questioned value of silver (30 mg/kg) in the yellow area may not be an outlier; the distribution of silver could not be defined, so the Dixon's test was performed on untransformed and lognormally transformed data. Using untransformed data, the value of 30 mg/kg appeared to be an outlier at alpha = 0.05, but not at alpha = 0.01. Using log-transformed data, the value of 30 mg/kg is not an outlier at either alpha = 0.05 or =0.01. It is recommended that this value be retained because the results of the outlier test are not unequivocal, and it is very possible that the distribution of silver is indeed lognormal. Additionally, there is no site history to indicate that silver would be site-related at any part of the base.

The sample identification number associated with the outlying zinc value is M-BG3-000 and for beryllium is B12-08-000. Additionally, the inorganic results associated with sample 280-S16-028 were removed from the yellow background data set due to an outlying value of lead, as agreed in the February 26, 1997 interagency meeting. Removal of these samples decreases the inorganic chemical sample sizes to

88 for the blue area, 50 for the pink area, and 55 for the yellow area. Revised data summaries are attached as Tables 1 through 3.

The 80LCL/95 concentrations for inorganic chemicals were calculated using the formula presented in the Statistical Methodology for Background Comparisons (NAS Alameda), which can also be found in Statistical Methods for Environmental Pollution Monitoring (Gilbert 1987). The calculation was performed on untransformed data for normally distributed data and for data for which a distribution could not be determined. For lognormally distributed data, the 80LCL/95 calculation was performed on the natural logarithm-transformed data. These concentrations were calculated after removal of sample M-BG3-000 in the blue area, B12-08-000 in the pink area, and 280-S16-28 in the yellow area. A value of one-half the sample quantitation limit was substituted for nondetect results. The 80LCL/95 concentration was not calculated for organic chemicals because this value will not be used in the assessment of anthropogenic organic chemicals.

If you have any questions or comments regarding these calculations, please call me at (303) 914-1752.

Sincerely,

Theresa K. Lopez

Theresa K. Lopez
Senior Toxicologist

cc: Susan Willoughby, PRC
Duane Balch, PRC

EPA. 1996. Guidance for Data Quality Assessment. EPA QA/G-9. Quality Assurance Division, Washington, D.C. February.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold. New York.

TABLE 1
NAS ALAMEDA
BACKGROUND DATA FOR BLUE AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Inorganic Chemicals (mg/kg)									
Aluminum[2]	NA	88/88	2,880	26,800	5,703	1.6	7,078	0.06	15,509
Antimony[1]	0.46-9.2	2/88	0.89	1.0	1.8	1.3	2.0	0.71	4.4
Arsenic[2]	0.61-13	33/88	0.74	23.0	2.2	2.9	4.8	1.3	19.2
Barium[1]	24-25	85/88	0.30	198	48.6	32.4	55.5	0.67	114.9
Beryllium[1]	0.2-1.3	25/88	0.09	0.77	0.32	0.21	0.36	0.67	0.76
Cadmium[1]	0.06-1.3	29/88	0.1	0.82	0.31	0.23	0.36	0.73	0.78
Calcium[1]	NA	88/88	1,360	19,200	3,033	1.9	4,181	0.08	10,958
Chromium[1]	NA	88/88	11.4	81.7	33.6	13	36.4	0.39	60.1
Cobalt[1]	3.9-6.8	66/89	1.9	14	5.0	2.7	5.6	0.54	10.6
Copper[2]	5.8-6.3	83/89	4.2	89.4	10.4	2.0	15.1	0.30	42.7
Iron[1]	NA	88/88	760	26,900	10,013	5,072	11,087	0.51	20,390
Lead[2]	1.4-6.8	27/88	1.3	41	3.2	2.2	5.2	0.66	16.1
Magnesium[2]	NA	88/88	1,510	42,400	2,557	1.6	3,159	0.06	6,858
Manganese[1]	NA	88/88	50	1,060	126	1.7	160	0.11	365
Nickel[1]	NA	88/88	11.6	88.5	26.9	1.5	31.9	0.13	63.4

TABLE 1 (CONTINUED)
NAS ALAMEDA
BACKGROUND DATA FOR BLUE AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Potassium[2]	610	87/88	310	6,382	800	1.6	997	0.07	2,203
Selenium[3]	0.42-13	1/88	5.7	5.7	2.9	2.1	3.3	0.72	7.1
Silver[3]	0.18-6.5	2/88	0.44	0.61	0.95	1.2	1.2	1.2	3.4
Sodium[2]	288-650	68/88	88.1	3,510	299.8	2.2	473.1	0.14	1,473
Thallium[3]	0.36-13	1/88	5.3	5.3	2.4	2.2	2.8	0.93	6.9
Titanium[1]	NA	66/66	223	1,020	408.4	145.8	444.3	0.36	706.7
Vanadium[1]	NA	88/88	12.8	62.3	22.4	8.8	24.2	0.40	40.5
Zinc[3]	NA	88/88	14	84	26.2	1.5	31	0.13	61.0
Polycyclic Aromatic Hydrocarbons (ug/kg)									
Acenaphthene[3]	83-14,000	1/85	130	130	293.1	743.2	453.5	2.5	NA
Anthracene[3]	83-14,000	2/85	59	390	294.2	743.5	454.7	2.5	NA
Benzo(a)anthracene[4]	100-14,000	8/85	61	1,000	290.1	747.9	451.5	2.6	NA
Benzo(a)pyrene[3]	140-14,000	11/85	48	1,300	208.4	1.8	277.3	0.11	NA
Benzo(b)fluoranthene[2]	100-14,000	9/85	66	760	202.4	1.8	273.9	0.11	NA
Benzo(g,h,i)perylene[4]	170-14,000	6/85	140	950	304.6	745.8	465.6	2.4	NA
Benzo(k)fluoranthene[2]	100-14,000	6/85	100	1,100	208.1	1.8	280.9	0.11	NA

TABLE I (CONTINUED)
NAS ALAMEDA
BACKGROUND DATA FOR BLUE AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Chrysene[1]	100-14,000	11/85	58	1,300	288.9	752.6	451.3	2.6	NA
Dibenzo(a,h) anthracene[1]	170-14,000	1/85	230	230	296.4	742.4	456.7	2.5	NA
Fluoranthene[1]	83-14,000	12/85	54	2,000	198.2	1.9	284.2	0.13	NA
Fluorene[1]	83-14,000	1/85	100	100	292.7	743.3	453.2	2.5	NA
Indeno(1,2,3-c,d)-pyrene[1]	170-14,000	6/85	120	930	215.2	1.7	279.3	0.10	NA
Naphthalene[1]	83-14,000	1/85	35	35	292.3	743.5	452.8	2.5	NA
2-Methylnaphthalene[1]	100-14,000	1/85	320	320	294.2	742.9	454.6	2.5	NA
Phenanthrene[1]	83-14,000	8/85	27	1,600	196	2.0	284.2	0.13	NA
Pyrene[1]	83-14,000	12/85	65	2,500	343.4	785.3	484.6	2.3	NA

Notes:

SQL	Sample Quantitation Limit
95 UCL	95 percent Upper Confidence Limit of the Mean Concentration
CV	Coefficient of Variation
80LCL/95th percentile	80th percent Lower Confidence Limit of the 95th percentile of the distribution
NA	Not applicable
mg/kg	milligrams per kilogram
ug/kg	micrograms per kilogram

(1) Data normally distributed

TABLE 1 (CONTINUED)
NAS ALAMEDA
BACKGROUND DATA FOR BLUE AREA
DATA SUMMARY

(2) Data lognormally distributed. Calculated CV and 80LCL/95 for natural logarithm-transformed data.
(3) Too few detections to determine distribution. Calculated CV and 80LCL/95th percentile from arithmetic mean and standard deviation.
(4) Data are not normally or lognormally distributed. Calculated CV and 80LCL/95th percentile from arithmetic mean and standard deviation.

TABLE 2
NAS ALAMEDA
BACKGROUND DATA FOR PINK AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Inorganic Chemicals (mg/kg)									
Aluminum[2]	NA	55/55	1,760	22,600	5,231	1.6	6,528	0.05	12,930
Antimony[1]	0.46-11.0	18/55	0.7	8.6	2.2	1.8	2.7	0.84	5.7
Arsenic[2]	0.59-10	45/55	0.44	15.6	1.8	2.4	3.1	1.4	8.7
Barium[2]	NA	55/55	6.9	156	36.0	1.7	47.4	0.15	103
Beryllium[1]	0.15-1.0	28/55	0.25	1.47	0.50	0.35	0.60	0.71	1.2
Cadmium[2]	0.08-1.0	11/55	0.1	3.2	0.19	2.7	0.42	0.59	1.33
Calcium[2]	NA	55/55	816	66,600	2,913	2.1	4,686	0.09	12,513
Chromium[1]	NA	55/55	15.6	66.7	30.4	9.9	33.1	0.33	50.0
Cobalt[4]	3.96-5.7	48/55	3.0	49.7	6.1	6.7	7.9	1.1	19.3
Copper[2]	8.8-10.2	52/55	3.1	49.1	7.5	1.8	10.5	0.29	24.3
Iron[2]	NA	55/55	4,500	27,900	9,365	1.5	11,230	0.04	20,394
Lead[3]	1.9-3.0	51/55	0.47	165	4.1	2.8	9.9	0.01	32.6
Magnesium[2]	NA	55/55	1,290	8,800	2,627	1.5	3,172	0.05	5,969
Manganese[2]	NA	55/55	55.5	748	126.1	1.7	167.6	0.11	363.1
Mercury[2]	0.06-0.27	7/54	0.057	2.71	0.063	2.4	0.12	0.31	0.34

TABLE 2 (CONTINUED)
NAS ALAMEDA
BACKGROUND DATA FOR PINK AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Nickel[2]	NA	55/55	11.5	80.4	25.8	1.4	30.1	0.10	49.7
Potassium[2]	NA	55/55	209	2,480	683	1.5	819	0.06	1,523
Silver[1]	0.18-1.47	11/55	0.32	5.6	0.30	2.5	0.58	0.74	1.73
Sodium[2]	NA	55/55	62.6	1,580	335.9	1.9	503.4	0.11	1,251
Titanium[1]	NA	1/1	518	518	518	NA	NA	NA	NA
Vanadium[1]	NA	55/55	10.5	55.3	22.6	9.0	25.1	0.40	44.6
Zinc[2]	18	54/55	10	191	22.6	1.7	29.2	0.16	61.5
Polycyclic Aromatic Hydrocarbons (ug/kg)									
Acenaphthylene[3]	70-3,400	1/56	150	150	121.6	226.2	182.3	1.9	NA
Anthracene[3]	70-3,400	1/56	240	240	123.2	226.8	184.1	1.8	NA
Benzo(a)anthracene[3]	100-3,400	1/56	1,600	1,600	497.1	2,264.3	1,105.0	4.6	NA
Benzo(a)pyrene[3]	140-3,400	1/56	2,600	2,600	186.4	394.9	292.4	2.1	NA
Benzo(b)fluoranthene[3]	100-3,400	1/56	2,300	2,300	168.1	366.1	266.4	2.2	NA
Benzo(g,h,i)perylene[3]	160-3,400	1/56	1,700	1,700	177.1	300.4	257.7	1.7	NA
Benzo(k)fluoranthene[3]	100-3,400	1/56	620	620	138.1	232.9	200.6	1.7	NA

TABLE 2 (CONTINUED)
NAS ALAMEDA
BACKGROUND DATA FOR PINK AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Chrysene[1]	100-3,400	1/56	1,500	1,500	153.8	288.9	231.4	1.9	NA
Fluoranthene[1]	70-3,400	3/56	34	3,600	207.5	477.0	355.6	2.3	NA
Indeno(1,2,3-c,d)-pyrene [1]	160-3,400	1/56	1,800	1,800	178.8	309.8	262.0	1.7	NA
Naphthalene[1]	70-3,400	1/56	99	99	120.7	226.2	181.4	1.9	NA
Phenanthrene[1]	70-3,400	2/56	240	2,200	131.3	291.1	209.4	2.2	NA
Pyrene[1]	70-3,400	3/56	210	6,100	240.5	831.0	463.5	3.5	NA

Notes:

SQL	Sample Quantitation Limit
95 UCL	95 percent Upper Confidence Limit of the Mean Concentration
CV	Coefficient of Variation
80LCL/95th percentile	80th percent Lower Confidence Limit of the 95th percentile of the distribution
NA	Not applicable
mg/kg	milligrams per kilogram
ug/kg	micrograms per kilogram

(1) Data normally distributed
(2) Data lognormally distributed. Calculated CV and 80LCL/95 for natural logarithm-transformed data.
(3) Too few detections to determine distribution. Calculated CV and 80LCL/95 from arithmetic mean and standard deviation.
(4) Data are not normally or lognormally distributed. Calculated CV and 80LCL/95 from arithmetic mean and standard deviation

TABLE 3
NAS ALAMEDA
BACKGROUND DATA FOR YELLOW AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Inorganic Chemicals (mg/kg)									
Aluminum[1]	– NA	50/50	20	13,300	6,119	2,543	6,841	0.42	11,091
Antimony[3]	2.5-7.3	3/50	2.8	3.6	3.0	0.61	3.1	0.21	4.2
Arsenic[1]	10-12	21/50	1.1	33	7.7	6.5	9.5	0.84	20.3
Barium[2]	21-24	43/50	19.8	260	30.0	1.8	43.0	0.18	99.4
Beryllium[1]	1-1.2	9/50	0.3	1.3	0.57	0.19	0.63	0.33	0.95
Cadmium[1]	0.36-1.2	11/50	0.33	2.9	0.66	0.49	0.80	0.75	1.6
Calcium[3]	NA	50/50	500	97,000	3,411	2.0	5,256	0.08	12,995
Chromium[4]	NA	50/50	5.0	69.7	32.0	8.4	34.4	0.10	48.5
Cobalt[1]	5-6	20/50	4.3	11.4	4.3	2.3	5.0	0.54	2.6
Copper[1]	5.5-5.6	48/50	4.2	49	15.7	12.1	19.1	0.77	39.3
Iron[1]	NA	50/50	10	20,800	10,247	3,859	11,410	0.38	17,791
Lead[3]	NA	50/50	3.3	180	20.7	2.4	41.2	0.29	118
Magnesium[2]	NA	50/50	500	8,820	2,540	1.6	3,192	0.06	6,231
Manganese[1]	NA	50/50	5.0	330	136.2	74.1	157.3	0.54	281
Mercury[1]	0.05-0.11	5/9	0.05	0.18	0.08	0.06	0.12	0.72	0.15

TABLE 3 (CONTINUED)
NAS ALAMEDA
BACKGROUND DATA FOR YELLOW AREA
DATA SUMMARY

Chemical	SQL	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	95 UCL	CV	80LCL/95th percentile
Nickel[4]	NA	50/50	5.0	71.1	27.7	9.9	30.5	0.36	46.7
Potassium[1]	NA	50/50	500	1,700	914	289	996	0.32	1,479
Silver[4]	0.48-6	6/50	0.52	30	2.9	4.1	4.1	1.4	11.0
Sodium[1]	500-610	11/50	232	1,380	358	260	432	0.73	867
Titanium[1]	NA	41/41	280	663	456	77.1	480.2	0.17	603
Vanadium[1]	NA	50/50	15.6	50.0	25.5	7.9	27.7	0.31	40.9
Zinc[1]	NA	50/50	17.0	140.0	46.9	31.6	55.8	0.67	108.6
Polycyclic Aromatic Hydrocarbons (ug/kg)									
Benzo(a)pyrene[1]	84-6,700	1/51	24	24	400.4	487.1	537.4	1.2	NA
Benzo(g,h,i)perylene[3]	96-6,700	1/51	19	19	402.2	485.9	538.9	1.2	NA
Chrysene[3]	60-6,700	2/51	22	130	398.2	488.7	535.6	1.2	NA
Fluoranthene[3]	48-6,700	3/51	30	790	407.0	492.1	545.4	1.2	NA
Indeno(1,2,3-c,d)-pyrene[3]	96-6,700	1/51	21	21	402.2	485.9	538.9	1.2	NA
Phenanthrene[3]	48-6,700	2/51	120	200	401.9	486.7	538.8	1.2	NA
Pyrene[3]	48-6,700	4/51	33	900	411.1	492.8	549.7	1.2	NA

ATTACHMENT A
OUTLIER TEST CALCULATIONS

Beryllium - Outlier Evaluation Using Rosner's Test									
Pink Area									
Data:								Potential	Potential
Sample	Depth Range		Chemical	Conc.	Units	Qualifier	All detects	Outlier 1	Outlier 2
280-RA-033	0.0	1.5	BERYLLIUM	0.96000	MG/KG	UJ			
280-RA-034	2.5	3.5	BERYLLIUM	0.89000	MG/KG	UJ			
280-RA-035	5.0	6.0	BERYLLIUM	0.62000	MG/KG	UJ			
280-RA-039	0.0	1.0	BERYLLIUM	0.88000	MG/KG	UJ			
280-RA-040	2.0	3.0	BERYLLIUM	0.53000	MG/KG	UJ			
280-RA-041	3.5	4.5	BERYLLIUM	0.25000	MG/KG	U			
280-RA-042	0.0	1.5	BERYLLIUM	0.54000	MG/KG	UJ			
280-RA-043	2.5	3.5	BERYLLIUM	0.54000	MG/KG	UJ			
280-RA-044	5.0	6.0	BERYLLIUM	0.36000	MG/KG	UJ			
280-RA-045	0.0	1.5	BERYLLIUM	0.55000	MG/KG	UJ			
280-RA-046	2.5	3.5	BERYLLIUM	0.52000	MG/KG	UJ			
280-RA-047	5.0	6.0	BERYLLIUM	0.54000	MG/KG	UJ			
280-RA-048	0.0	1.5	BERYLLIUM	0.67000	MG/KG	J	0.67000	0.67000	0.67000
280-RA-049	2.5	3.5	BERYLLIUM	0.61000	MG/KG	J	0.61000	0.61000	0.61000
280-RA-050	5.0	6.0	BERYLLIUM	0.38000	MG/KG	J	0.38000	0.38	0.38
B06-07-000	0.5	1.0	BERYLLIUM	0.56799	MG/KG		0.56799	0.56799	0.56799
B06-07-002	2.0	3.3	BERYLLIUM	0.34100	MG/KG		0.34100	0.341	0.341
B06-07-008	8.0	9.5	BERYLLIUM	0.16200	MG/KG	U			
B06-08-000	1.0	1.5	BERYLLIUM	0.31600	MG/KG		0.31600	0.316	0.316
B06-08-002	2.0	3.0	BERYLLIUM	0.60300	MG/KG		0.60300	0.603	0.603
B06-08-007	6.5	7.5	BERYLLIUM	0.77900	MG/KG		0.77900	0.779	0.779
B07B-02-000	0.5	1.5	BERYLLIUM	0.89900	MG/KG		0.89900	0.899	0.899
B07B-02-004	3.5	5.0	BERYLLIUM	1.25000	MG/KG		1.25000	1.25	1.25
B10-04-000	0.5	1.0	BERYLLIUM	0.68999	MG/KG		0.68999	0.68999	0.68999
B10-04-005	5.0	6.0	BERYLLIUM	0.15000	MG/KG	U			
B12-08-000	0.5	1.0	BERYLLIUM	2.29000	MG/KG	J	2.29000		
B12-08-004	3.5	5.0	BERYLLIUM	0.95400	MG/KG	J	0.95400	0.954	0.954
B12-08-010	9.5	10.0	BERYLLIUM	1.05000	MG/KG	J	1.05000	1.05	1.05
F10 [0.0-0.0]	0.0	0.0	BERYLLIUM	1.00000	MG/KG	U			
M-006A-0	2.0	2.5	BERYLLIUM	0.94600	MG/KG		0.94600	0.946	0.946
M-006A-005	3.5	4.5	BERYLLIUM	1.18000	MG/KG	J	1.18000	1.18	1.18
M-101A-004	2.0	3.5	BERYLLIUM	0.86500	MG/KG	J	0.86500	0.865	0.865
M-102A-004	2.0	3.3	BERYLLIUM	0.57200	MG/KG	J	0.57200	0.572	0.572
M-106A-0	0.0	0.0	BERYLLIUM	0.24600	MG/KG		0.24600	0.246	0.246
M-106A-003	2.0	3.0	BERYLLIUM	0.60900	MG/KG	J	0.60900	0.609	0.609
M-107A-0	0.0	0.0	BERYLLIUM	0.26300	MG/KG		0.26300	0.263	0.263
M-107A-002	0.5	2.0	BERYLLIUM	0.53100	MG/KG	J	0.53100	0.531	0.531
M-109A-0	0.0	0.0	BERYLLIUM	1.01000	MG/KG		1.01000	1.01	1.01
M-109A-007	5.5	6.3	BERYLLIUM	0.83200	MG/KG	J	0.83200	0.832	0.832
M-110A-003	1.5	3.0	BERYLLIUM	1.47000	MG/KG	J	1.47000	1.47	
M-111A-0	0.5	0.0	BERYLLIUM	1.35000	MG/KG	J	1.35000	1.35	1.35
M-111A-003	2.0	3.5	BERYLLIUM	0.38000	MG/KG	J	0.38000	0.38	0.38
M-BG1-002	2.0	2.5	BERYLLIUM	0.79200	MG/KG		0.79200	0.792	0.792
M-BG1-003	3.0	3.5	BERYLLIUM	0.76300	MG/KG	U			

Arsenic - Outlier evaluation Using Dixon's Test

Yellow Area

Data are normally distributed

Potential Outlier is Arsenic = 33 mg/kg

Chemical	Detected Result	Units
Arsenic	1.11	
Arsenic	1.62	
Arsenic	1.74	
Arsenic	1.9	
Arsenic	2.19	
Arsenic	3.31	
Arsenic	3.8	
Arsenic	4.83	
Arsenic	5.45	
Arsenic	7.75	
Arsenic	11	
Arsenic	11	
Arsenic	11	
Arsenic	11	
Arsenic	11	
Arsenic	11	
Arsenic	13	
Arsenic	19	
Arsenic	21	
Arsenic	22	
Arsenic	28	
Arsenic	33	

N = 22

Dixon's Test

C = 0.156788962

Critical Value at alpha = 0.05 is 0.43

Based on the results of this test, As at 33 mg/kg is not an outlier at alpha = 0.05

Zinc Outlier Evaluation Using Rosners Test
Blue Ares

Zinc - Outlier Evaluation Using Rosner's Test					
Blue Area					
Zinc is Lognormally Distributed					
Data:	Potential Outlier 1		Potential		
Chemical	Result	LN Result	Outlier 2	Units	Qualifier
ZINC	17.80000	2.87920	2.87920	MG/KG	
ZINC	17.80000	2.87920	2.87920	MG/KG	
ZINC	19.50000	2.97041	2.97041	MG/KG	
ZINC	22.10000	3.09558	3.09558	MG/KG	
ZINC	19.00000	2.94444	2.94444	MG/KG	
ZINC	20.00000	2.99573	2.99573	MG/KG	
ZINC	19.00000	2.94444	2.94444	MG/KG	
ZINC	18.30000	2.90690	2.90690	MG/KG	
ZINC	17.90000	2.88480	2.88480	MG/KG	
ZINC	17.70000	2.87356	2.87356	MG/KG	
ZINC	21.40000	3.06339	3.06339	MG/KG	
ZINC	17.90000	2.88480	2.88480	MG/KG	
ZINC	17.30000	2.85071	2.85071	MG/KG	
ZINC	15.70000	2.75366	2.75366	MG/KG	
ZINC	17.20000	2.84491	2.84491	MG/KG	
ZINC	17.10000	2.83908	2.83908	MG/KG	
ZINC	20.20000	3.00568	3.00568	MG/KG	
ZINC	22.40000	3.10906	3.10906	MG/KG	
ZINC	32.40000	3.47816	3.47816	MG/KG	
ZINC	40.40000	3.69883	3.69883	MG/KG	
ZINC	54.20000	3.99268	3.99268	MG/KG	
ZINC	31.80000	3.45947	3.45947	MG/KG	
ZINC	27.40000	3.31054	3.31054	MG/KG	
ZINC	34.90000	3.55249	3.55249	MG/KG	
ZINC	63.40000	4.14946	4.14946	MG/KG	
ZINC	80.60000	4.38950	4.38950	MG/KG	
ZINC	33.30000	3.50556	3.50556	MG/KG	
ZINC	53.50000	3.97968	3.97968	MG/KG	
ZINC	27.50000	3.31419	3.31419	MG/KG	
ZINC	17.70000	2.87356	2.87356	MG/KG	
ZINC	17.40000	2.85647	2.85647	MG/KG	
ZINC	84.00000	4.43082		MG/KG	
ZINC	33.00000	3.49651	3.49651	MG/KG	
ZINC	30.00000	3.40120	3.40120	MG/KG	
ZINC	20.00000	2.99573	2.99573	MG/KG	
ZINC	67.00000	4.20469	4.20469	MG/KG	
ZINC	23.00000	3.13549	3.13549	MG/KG	
ZINC	30.00000	3.40120	3.40120	MG/KG	
ZINC	25.00000	3.21888	3.21888	MG/KG	
ZINC	25.00000	3.21888	3.21888	MG/KG	
ZINC	17.00000	2.83321	2.83321	MG/KG	
ZINC	14.00000	2.63906	2.63906	MG/KG	
ZINC	26.00000	3.25810	3.25810	MG/KG	

Zinc Outlier Evaluation Using Rosners Test
Blue Ares

Rk		6.06851	2.99496		
Critical Value at alpha = 0.05		3.35000	3.35000		
Potential Outlier 1					
ZINC	316.00000	5.75574			
Potential Outlier 2					
ZINC	84.00000	4.43082			
Based on these results, the highest hit of Zn (316) is an outlier					
but no other value is an outlier					

ATTACHMENT B
TECHNICAL MEMORANDUM FOR ESTIMATION OF AMBIENT METAL CONCENTRATIONS IN SHALLOW GROUNDWATER

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)
Northern and Central California, Nevada, and Utah
Number N62474-94-D-7609
Contract Task Order Number 0108

Prepared For
DEPARTMENT OF THE NAVY
Patricia McFadden, Remedial Project Manager
Engineering Field Activity West
Naval Facilities Engineering Command
San Bruno, California

TECHNICAL MEMORANDUM ESTIMATION OF AMBIENT METAL CONCENTRATIONS IN SHALLOW GROUNDWATER

ALAMEDA POINT
ALAMEDA, CALIFORNIA

August 1998

Prepared By
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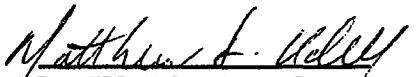


Matt Udell, Project Manager

CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION

This technical memorandum describes Navy's approach for estimating the concentrations of ambient metals in shallow groundwater at Alameda Point and presents the ambient metals concentrations determined for the shallow groundwater. The term "shallow groundwater" refers to the first water-bearing zone at Alameda Point. The second water-bearing zone was not evaluated due to extensive salt water intrusion. The estimated concentrations of ambient metals are intended for use in the baseline human health risk assessment (HHRA), ecological risk assessment (ERA), and the remedial investigation (RI) of the Installation Restoration Program (IRP) sites at Alameda Point. The approach for estimating the concentrations of ambient metals in groundwater documented in this technical memorandum was discussed and agreed upon during technical and base realignment and closure (BRAC) cleanup team (BCT) meetings between the Navy and the regulatory agencies in April and May, 1998.

1.1 PURPOSE

Inorganic constituents in groundwater may be naturally occurring, the result of contamination by a potentially responsible party (PRP), or anthropogenic (resulting from human activities unrelated to a PRP). Since inorganic constituents occur naturally in groundwater, it is important to determine if naturally occurring inorganic constituents, specifically metals, are chemicals of concern (COC). COCs are an integral part of the baseline HHRA and ERA. Metals are COCs when detected in groundwater samples above the estimated background concentration. The term "background" is typically used to describe naturally occurring levels of inorganic constituents in groundwater. A distinction between the term "background" and the term "ambient" will be made later in this section. Comparing the IR site data to background data is designed to (1) limit remediation of chemicals that are present in the environment due to natural or non-PRP causes, and (2) focus the RI on contamination that poses a risk to human health or the environment. Finally, if remediation is required at a site, background values are considered when establishing cleanup goals.

Metals occur naturally in groundwater, the concentrations of which vary among locations. These inherent variations in metals concentrations can potentially arise from several factors, including (1) differences in overlying soil characteristics in the recharge zone, (2) differences in subsurface hydrostratigraphy, (3) differences in geochemistry, and (4) position within the groundwater flow system.

Some concentrations of metals in groundwater at Alameda Point may not be naturally occurring, but are unrelated to Naval activities at Alameda Point. A review of the history of Alameda Point construction indicates that almost the entire facility is located on marshland, tidal flats, and bay margin (submerged land) that has been filled with sediment dredged from the Oakland Inner Harbor, San Francisco Bay, and the ship channel/ Seaplane Lagoon area. The species and concentration of metals present in the fill sediment are not known, but may have been impacted by industrial activities along the Oakland Bayshore and Alameda Island pre-fill bay margins. Because the term "background" typically refers to concentrations that are present naturally, it is more appropriate to use the term "ambient" to describe the concentrations of metals that are not related to site-specific contamination. The term "ambient" is used in this technical memorandum to describe levels of inorganic constituents in groundwater that are unrelated to site-specific Naval activities.

Because ambient concentrations in groundwater are expected to vary among locations within a single hydrostratigraphic unit, it is appropriate to consider ambient concentrations as a distribution of values rather than a single value due to the natural variation of metals in the environment. For the purpose of screening potential COCs for risk assessment, it is often more practical to use a single value (a high value on the upper end of the ambient distribution) to determine whether the levels of inorganic constituents at an IR site are significantly higher than ambient concentrations. Use of a value at the low end or middle of the ambient distribution might suggest risk due to naturally occurring metals. This approach is more straightforward than trying to compare the distribution of the ambient data to the distribution of the IR site data. The ambient concentrations discussed and presented in this memorandum represent the estimated high value on the upper end of the ambient distribution. When comparing the ambient concentrations presented in this document to IR site data in future risk assessments, the distribution of the concentrations of ambient metals will also be considered.

1.2 APPROACH

During technical meetings between the Navy and regulatory agencies held on April 28 and 29, 1998, the BCT decided to follow a statistical approach for the determination of the concentrations of ambient metals in groundwater similar to that used to determine the concentrations of ambient metals in soils at Alameda Point (Tetra tech EM Inc. [TtEMI] 1997). This simplified approach was followed because of the transitory nature of groundwater and the following factors arising from the construction of Alameda Point:

- The presence of anthropogenic metals in fill sediment
- The slow leaching of both naturally-occurring and anthropogenic metals from the marine sediments into the groundwater
- The marine-derived fill sediment was placed in a column of sea water which now serves as the aquifer material for the first water bearing zone
- The disequilibrium of groundwater chemistry due to the slow flushing of saline connate water from the pore spaces and the large geochemical gradients that occur within small horizontal and vertical distances
- Existing and potential future sea water intrusion induced by remediation- or supply-based pumping

In consultation with the BCT, the Navy proposed estimating the concentration limits of ambient metals in the following manner:

- Select well locations that appear to be unaffected by IR site-related contamination to create an initial data set to be used to determine ambient concentrations of metals
- Compare all organic groundwater data from the initial data set to the 1996 tap water preliminary remediation goals (PRG) to exclude impacted wells
- Examine the initial data set using probability plots and Rosner's test to exclude outlier concentrations of metals
- Test the remaining data (without outliers) for normality using a statistical graphics program
- Prepare summary statistics and estimate the ambient concentrations of metals from the tested data set

Sections 2 and 3 of this report provide a detailed description of the process used to develop the ambient metals data set and the statistical procedure used to estimate the concentrations of ambient metals in groundwater at Alameda Point.

2.0 MONITORING WELL SELECTION AND DATABASE COMPILATION

Beginning in 1991, a number of environmental and geotechnical studies were conducted at Alameda Point in an effort to characterize environmental contamination that may have been caused by past activities at the air station. Over 260 monitoring wells were installed during these previous

investigations. These monitoring wells form the monitoring well network that was sampled for at least four quarters and was used to develop the ambient metals data set discussed in this report.

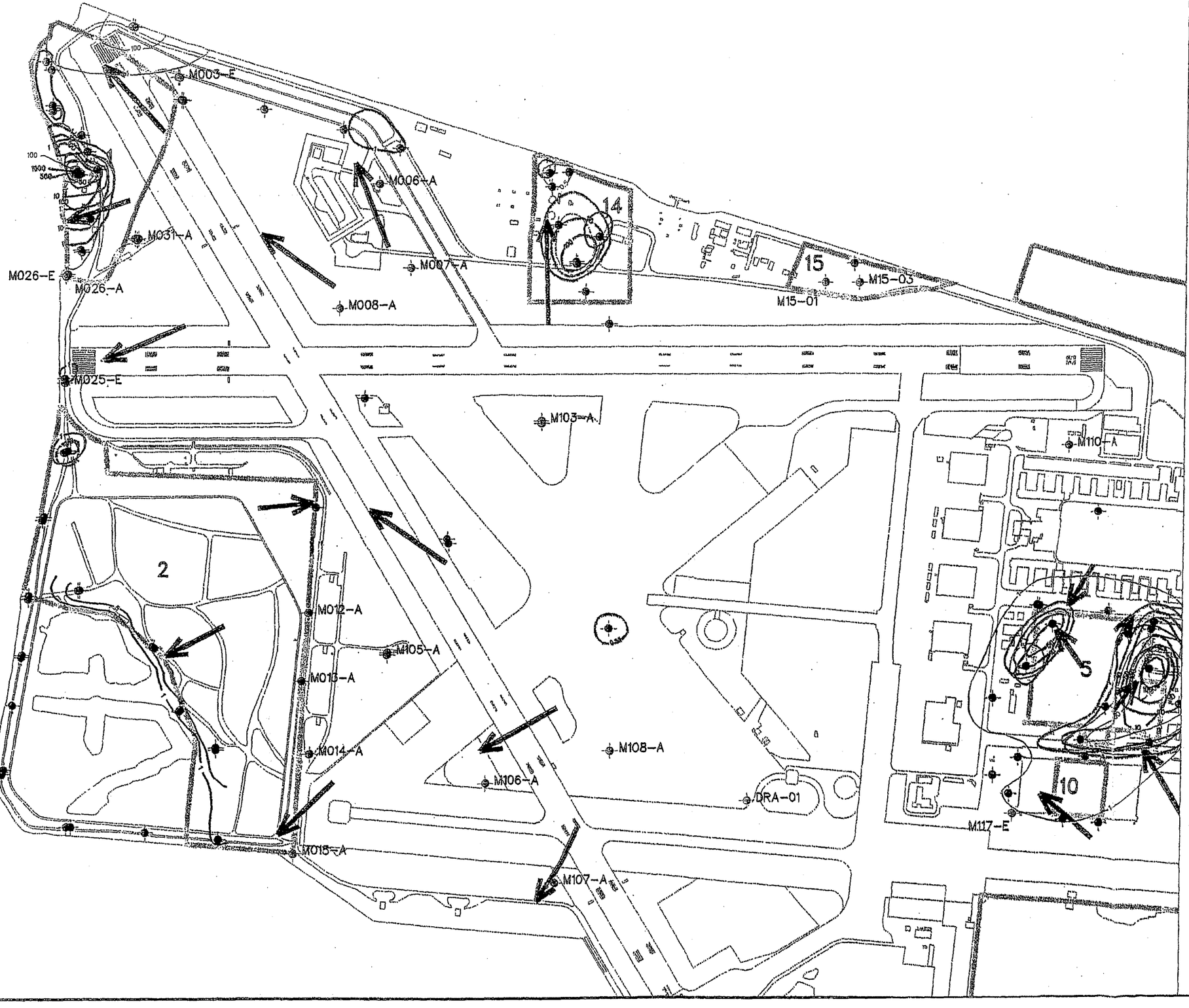
The data set used to determine the concentrations of ambient metals in groundwater was limited to groundwater samples collected from the first water-bearing zone. Groundwater samples collected from the second water-bearing zone were not included in the data set due to extensive saltwater intrusion and the inherent inability of analytical methods to detect trace metals in the presence of very high levels of marine salts.

Prior to the development of the current approach to estimate ambient metals concentrations in groundwater, four wells within the monitoring network (MBG-1, MBG-2, MBG-3, and MBG-4) were identified as ambient wells. However, based on our current approach these wells are not considered representative of shallow groundwater conditions at Alameda Point due to limited coverage and the small size of the data set. To achieve better lateral coverage and to expand the population of wells to be considered in estimating ambient concentrations, a working meeting was held between the Navy and regulatory agencies on May 11, 1998 to identify potential ambient wells using the criteria discussed below.

Monitoring wells were designated on a location-by-location basis as potential ambient wells if they met the following criteria:

- The well must not be located at an IR site that contains metals contamination based on site history
- The well must be located upgradient or cross-gradient from known sources of contamination at Alameda Point
- The well must not be located within any existing or previously identified organic contaminant plume
- The well must not be contaminated by any organic compound during any sampling event unless the detection was infrequent and the concentration was below 1996 tap water PRGs for the given compound

Based on the May 11, 1998 technical meeting and a subsequent comparison of potential ambient wells to tap water PRGs, 35 wells were identified as being unaffected by IR site-related groundwater contamination. These wells are referred to in this report as "unaffected wells". The 35 unaffected wells are as follows:



LEGEND

- MONITORING WELL USED FOR BACKGROUND
- MONITORING WELL FIRST WATER BEARING ZONE
- BENZENE PLUME
- TCE PLUME
- VINYL CHLORIDE PLUME
- 8 INSTALLATION RESTORATION SITE
- GROUNDWATER FLOW DIRECTION

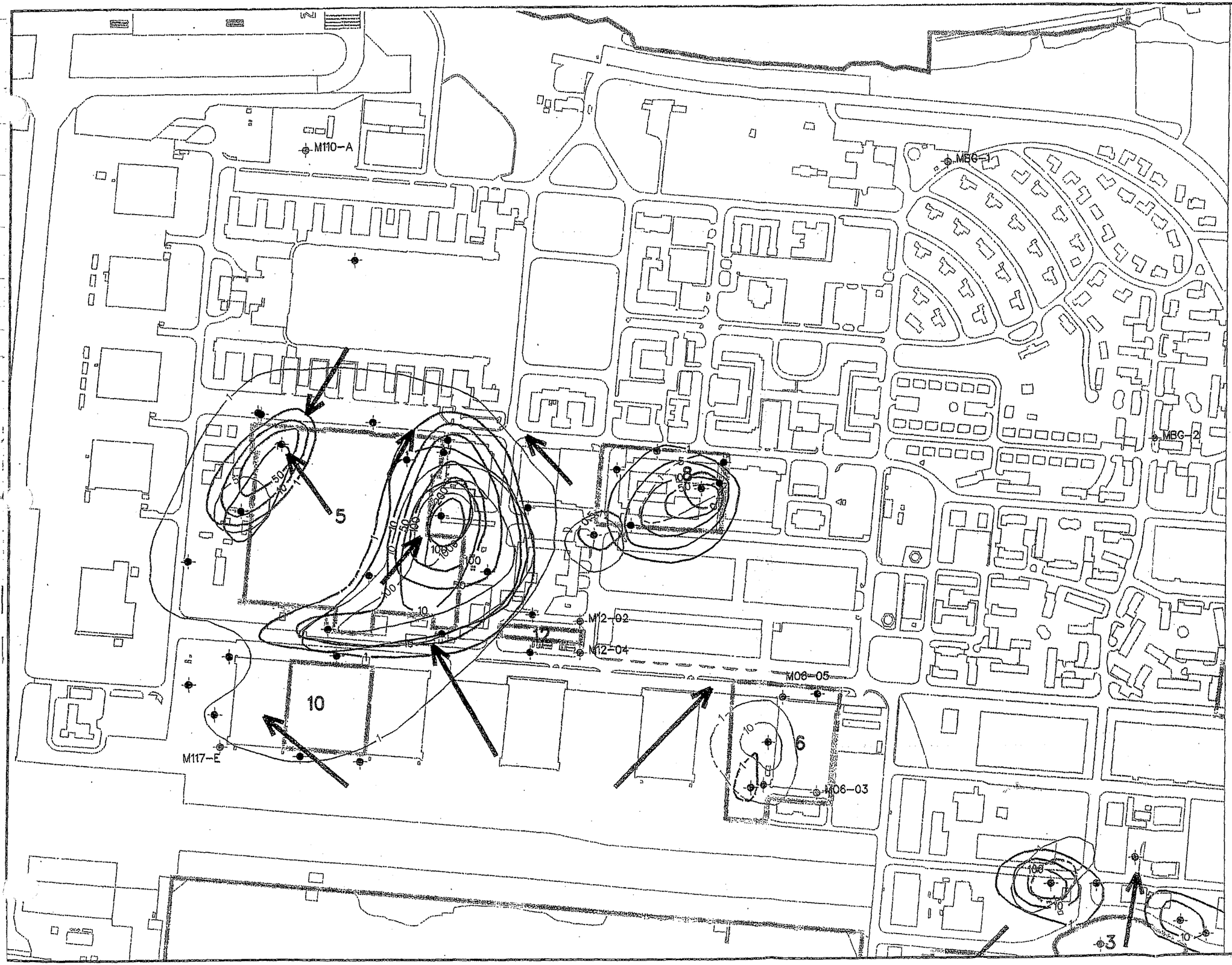
NOTE: PLUME CONCENTRATIONS ARE IN MICROGRAMS PER LITER

N

350 0 350 700

SCALE: 1" = 700'

FIGURE 1
MONITORING WELLS USED FOR DETERMINATION OF BACKGROUND METALS IN GROUNDWATER WESTERN REGION
ALAMEDA POINT
ALAMEDA, CALIFORNIA
4-A



LEGEND

- MONITORING WELL USED FOR BACKGROUND
- MONITORING WELL FIRST WATER BEARING ZONE
- BENZENE PLUME
- TCE PLUME
- VINYL CHLORIDE PLUME
- 8 INSTALLATION RESTORATION SITE
- GROUNDWATER FLOW DIRECTION

NOTE: PLUME CONCENTRATIONS ARE IN MICROGRAMS PER LITER

N

200 0 200 400

SCALE: 1" = 400'

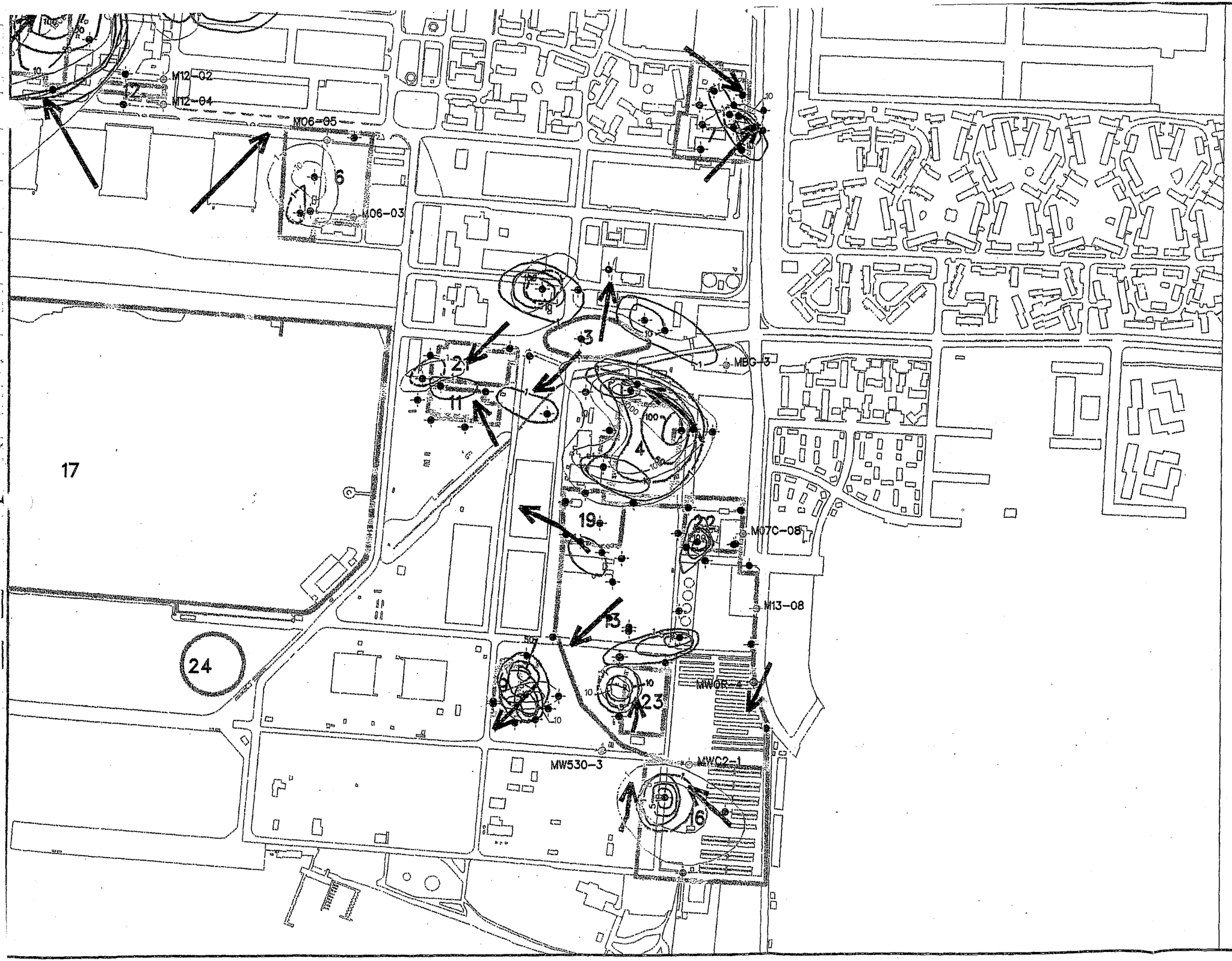
FIGURE 2

MONITORING WELLS USED FOR DETERMINATION OF BACKGROUND METALS IN GROUNDWATER CENTRAL REGION

ALAMEDA POINT

ALAMEDA, CALIFORNIA

4-B



17

LEGEND

- MONITORING WELL USED FOR BACKGROUND
- MONITORING WELL FIRST WATER BEARING ZONE
- BENZENE PLUME
- TCE PLUME
- VINYL CHLORIDE PLUME
- 8 INSTALLATION RESTORATION SITE
- GROUNDWATER FLOW DIRECTION

NOTE: PLUME CONCENTRATIONS ARE IN MICROGRAMS PER LITER

N

250 0 250 500

SCALE: 1" = 500'

FIGURE 3

MONITORING WELLS USED FOR DETERMINATION OF BACKGROUND METALS IN GROUNDWATER SOUTHEASTERN REGION
ALAMEDA POINT
ALAMEDA, CALIFORNIA
4-C

DRA-01	M013-A	M06-03	M108-A	M15-03
M003-E	M014-A	M06-05	M110-A	MBG-1
M006-A	M015-A	M07C-08	M117-E	MBG-2
M007-A	M025-E	M103-A	M12-02	MBG-3
M008-A	M026-A	M105-A	M12-04	MW530-3
M010-A	M026-E	M106-A	M13-08	MWOR-4
M012-A	M031-A	M107-A	M15-01	MWC2-1

Figures 1 through 3 show the locations of all wells initially screened (black symbol) and the locations of the 35 unaffected wells (red symbol) in each region of Alameda Point in relation to IR sites, contaminant plumes, and the direction of groundwater flow.

Filtered metals data, analyzed using Contract Laboratory Program (CLP) methodology, were used to constitute the ambient metals data set. Unfiltered metals data were not used due to large variations in turbidity values typically associated with unfiltered samples. Each of the 35 wells was sampled at least four times during the quarterly sampling; therefore, up to 188 separate measured concentrations were potentially available for each metal. However, fewer concentrations were available for hexavalent chromium due to infrequent analysis and for molybdenum due to analytical difficulties. A copy of the ambient data set was transmitted to the BCT for their review.

A question was raised by the BCT following their review, concerning the number of wells with reporting or method detection limits (MDL) that exceeded the 1996 tap water PRGs. After reviewing the data set, at least one chemical in all 35 wells yielded an MDL or reporting limit which exceeded the chemical-specific PRG. It is important to note that no chemical was actually detected above PRGs; only the numerical laboratory MDLs (without an actual chemical detected) exceeded a chemical-specific PRG.

Based on the aforementioned analysis, a discussion was held at the May 19, 1998 BCT meeting regarding wells with chemical-specific MDLs above PRGs. The BCT decided to retain all wells with a chemical-specific MDL exceeding the respective PRG due to the following factors:

- The MDLs represent the technologic limits of current (1998) analytical methods (the data were collected from 1991 to 1995),
- The low potential for a release in the vicinity of a proposed well, since the monitoring wells selected are not located near an IR site,

- The lack of a potential relationship between the undetected organic chemical and metals in groundwater,
- The fact that the Navy is screening for a potential release and not conducting a risk assessment for nondetected organics in groundwater.

In those cases where a metal was not detected in a groundwater sample, the BCT decided to use a value of one-half the chemical-specific reported detection limit to include in the data set.

3.0 STATISTICAL ANALYSIS

Statistical procedures consistent with U.S. Environmental Protection Agency (EPA) and Department of Toxic Substances Control (DTSC) guidance documents (EPA 1989; DTSC 1992, 1994) and current practices in the environmental industry were used to estimate ambient concentrations of metals in groundwater. The statistical analysis consisted of the following four steps:

- Nondetected data were substituted with numerical values at one-half the reported detection limit depending on the detection frequency.
- Outliers were identified and excluded from the data set.
- Data sets for metals with high detection frequencies were tested for normality
- Data were statistically summarized based on their probability distribution, and ambient screening concentrations were determined from the data.

Each of these steps is discussed separately below.

3.1 TREATMENT OF NONDETECTED DATA

Before the upper limits of the concentrations of ambient metals could be estimated, the data set for all metals required special preparation to assign numerical values to nondetected results. Typically, nondetected results are assigned numerical values equal to one-half of the reported detection limit, which varies from sample to sample due to dilution factors and variations in analytical instrument response. For all chemicals, a value of one-half the reported detection limit was substituted for each nondetected data point per agreements reached in the April and May 1998 BCT meetings.

3.2 EXCLUSION OF OUTLIERS

In any population, a few values may be significantly higher or lower than the main population, and can cause disproportionate statistical effects. To avoid these disproportionate effects, values that were significantly higher than others were identified as outliers and were excluded from the data set before estimating ambient concentrations.

Potential outliers in the data set were first visually identified using probability plots. A probability plot is a graph of values, ordered from lowest to highest, and plotted against cumulative percentile. The horizontal axis is scaled in units of the variable (in this case concentration), and the vertical axis is scaled in units of cumulative percent. The horizontal scale can be plotted either as a linear scale (cumulative percent versus concentration) or as a lognormal scale (cumulative percent versus the logarithm of concentration). Populations of data that plot as a straight line in a linear concentration scale are referred to as normally distributed, and populations that plot as a straight line on a logarithmic concentration scale are referred to as lognormally distributed.

Probability plots were constructed at an appropriate scale (normal or lognormal) for each metal, using up to 188 sample concentrations. Potential outliers for each metal were then visually identified as values that plotted a significant distance from the straight line along which the majority of the data were clustered. Rosner's test, described in EPA's Guidance for Data Quality Assessment (EPA 1996), was performed for those metals that appeared to be potential outliers based on visual inspection of the data. Rosner's test may be used with normally or lognormally distributed data. Rosner's test calculates a test value using the mean and standard deviation of the data set after removal of the suspected outlier. The calculated test value is then compared to a critical value corresponding to a particular level of significance and sample size (number of samples in a population). If the test value exceeds the critical value, the test value is considered an outlier and removed from the population. The test is repeated, iteratively removing test values, until the test value no longer exceeds the critical value. It should be noted that because the data points considered as anomalously high concentrations may also represent extreme values of actual ambient concentrations, exclusion of these data points may lead to conservative (low) estimates of ambient concentrations.

The original data set contained up to 188 samples for each metal. These data were lognormally transformed and detected values were plotted on a cumulative frequency chart. The following metals appeared to contain outliers after visual inspection of the lognormally transformed data plots: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc. Rosner's test was used to determine if the highest detected concentrations of

these metals were outliers. The results of Rosner's test indicated that the preceding list of metals did not contain outliers in their data subsets with the potential exceptions of: aluminum, cobalt, nickel, lead, vanadium, and zinc.

The outliers for aluminum, cobalt, nickel, lead, vanadium, and zinc were associated with samples from the following wells collected on the dates listed:

Well Identification	Sample Date	Chemicals with Potential Outliers
MW530-3	8/24/90	Aluminum, Cobalt, Copper, Nickel, Lead, Vanadium
MWC2-1	8/29/90	Aluminum, Cobalt, Copper, Nickel, Lead, Vanadium
MWOR-4	8/27/90	Aluminum, Cobalt, Copper, Nickel, Lead, Vanadium
M008-A	7/1/91	Aluminum
M014-A	9/25/91	Aluminum, Cobalt, Nickel, Lead, Vanadium, Zinc
M117-E	3/7/95	Zinc
M003-E	5/3/95	Lead
DRA-01	3/7/95	Zinc
M107-A	3/4/95	Nickel
M110-A	3/5/95	Lead, Nickel, Zinc
M15-03	3/8/95	Zinc

Review of the laboratory reports for the first six wells listed above revealed that the samples from the corresponding quarters had not been filtered, artificially elevating metal concentrations. Therefore, analytical results for those wells (for the above-listed dates only) were removed from the groundwater ambient data set for all metals. The March 1995 sample for M003-E had an anomalously high lead detection, the basis for which could not be determined. The May 1995 sample for well DRA-01 had a detection of zinc that was high and perhaps more representative of saline water in the second water-bearing zone. Therefore, samples from wells M003-E and DRA-01 collected on the above-listed dates were also removed.

The remaining samples did not have any apparent explanation for the anomalous results, although samples from M107-A and M110-A for March 1995 were reported as turbid, which may explain the higher hits of nickel, lead, and zinc. However, there is no apparent contamination near these wells and no indication of laboratory problems with the samples. Wells M107-A, M110-A, and M15-03 were sampled before and after the detections of the apparent outliers, and all results were low to nondetected

with low detection limits. Therefore, although there are anomalously high hits of lead, nickel, and zinc in these wells, the samples were retained in the ambient metals data set.

Based upon the previous discussion of exclusion of outliers, the final data set for each metal may contain up to 180 groundwater samples. However, the actual population of a metal subset (maximum population of 180 data points) may be limited by the frequency of detection for a specific metal. For example, although 180 groundwater samples are available from the ambient metals data set, the metal nickel was only detected 13 times yielding a frequency of detection of 13/180.

3.3 NORMALITY TESTING

After the removal of outliers, the data set was subjected to normality testing to objectively evaluate the distribution of the data. Normality testing is an analytical technique used to judge whether a data set is distributed normally or lognormally. The assumption of normality was tested using the Wilks-Shapiro Rank-Its plots. The normality tests were conducted using only detected values, which requires at least 5 values to provide a distribution. Graphical results of the normality tests are provided in the Attachment to this report for each metal with at least five detected results. Metals with fewer than five detected results were evaluated assuming a normal distribution.

3.4 ESTIMATION OF AMBIENT METALS CONCENTRATIONS

After treating nondetected values and removing outliers from the ambient metals data set, the data for each metal were statistically summarized to calculate mean concentrations and the ambient screening concentration (the 80^{th} percent lower confidence limit of the 95^{th} percentile of the distribution [80 LCL/95]). All data summaries were conducted on the natural-log transformed data, unless the data were normally distributed, in which case the data summaries were performed on untransformed data. The 80 LCL/95 concentration was calculated using the formula presented in Statistical Methods for Environmental Pollution Monitoring (Gilbert 1987). The concentration at the 95^{th} upper confidence limit (UCL) of the mean was also calculated for information purposes.

4.0 SUMMARY OF FINDINGS

Estimated ambient metals concentrations at both the 80 LCL/95 and 95 UCL for shallow groundwater at Alameda Point, statistical features of the data sets, and relevant water quality criteria are listed in Table

TABLE 1
AMBIENT CONCENTRATIONS OF METALS IN SHALLOW GROUNDWATER
ALAMEDA POINT

Inorganic Chemical [1]	Reported Detection Limit (ug/L)	Frequency of Detection	Minimum Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Mean Concentration (ug/L)	95 UCL Concentration (ug/L)	80 LCL/95 Concentration (ug/L)	MCL[2] (ug/L)
Aluminum	8.4-223	51/176	3	3970	32.12	96.2	439.13	1000
Antimony	2-37.5	12/176	2.5	47.8	5.83	11.8	45.77	6
Arsenic	1.9-100	94/179	2	40.7	4.54	8	28.39	50
Barium	4.3-55.4	144/176	2.3	1260	34.06	123.3	574.73	1000
Beryllium	0.1-3.7	18/176	0.94	3	0.49	1	3.83	4
Cadmium	0.2-8.0	16/176	0.32	6.5	0.53	1.3	5.38	5
Calcium	898-1370	176/180	620	513000	17865	78223	379269	NA
Hexavalent Chromium-n	100	1/3	4	4	34.7	100.6	NA	NA
Chromium	0.6-32	23/176	0.74	82.8	1.54	3.4	13.79	50
Cobalt	2.3-17.2	6/176	2.5	10.5	3.5	4.6	11.57	NA
Copper	0.4-69.7	54/176	2.1	27.3	3.97	7.5	27.48	1000
Iron	4.8-363	119/180	7.2	24400	108.58	1624	7135	300
Lead	0.8-20	18/180	1.2	28.4	0.91	1.3	3.88	NA
Magnesium	NA	180/180	549	1070000	15092	103358	500168	NA
Manganese	1.1-12.3	172/180	1.1	2480	86.01	1171	5213	50
Mercury-n	0.1-0.29	3/180	0.2	0.3	0.1	0.1	0.15	2
Molybdenum	2.0-25.4	5/100	3.1	19.4	4.59	5.6	11.52	NA
Nickel	1.7-49.1	13/180	2.7	151	5.6	7.4	19.06	100
Potassium	763-2340	175/180	1200	505000	14314	40552	182153	NA
Selenium-n	1.9-54	1/180	2.5	2.5	1.58	1.9	5.97	50
Silver-n	0.4-5.4	2/170	2.4	4.8	1.48	1.6	3.33	100
Sodium	NA	180/180	4600	8160000	198988	937369	4539829	NA
Thallium-n	1.7-76	3/175	3.6	5.2	2.21	2.3	5.8	2
Vanadium	1.4-19.5	69/180	2	50.8	4.97	8.4	28.65	NA
Zinc	0.5-32.8	55/180	2.8	46800	4.87	10.5	42.91	5000

Notes:
MCL = Maximum contaminant level
NA = Not available
NC = Not calculated
ug/L = microgram per liter
80 LCL/95 = 80th lower confidence limit on the 95th percentile of the distribution
95 UCL = 95th upper confidence limit

[1] — statistics for chemicals denoted with an "-n" are based on a normal distribution; too few detections were available to determine probability distribution.

[2] ndwater MCLs required to support municipal supply are based on the V Quality Control Plan, San Francisco Bay Basin, Region 2 (RWQCB 19

1. Wilks-Shapiro Rank-Its plots that support evaluation of normality are included in the Attachment to this report. The estimated concentrations of ambient metals in groundwater at the 80 LCL/95, in many cases, exceeded the maximum contaminant level (MCL) for municipal supply (RWQCB 1995). Estimated concentrations for antimony, cadmium, iron, manganese, and thallium exceeded their respective MCLs.

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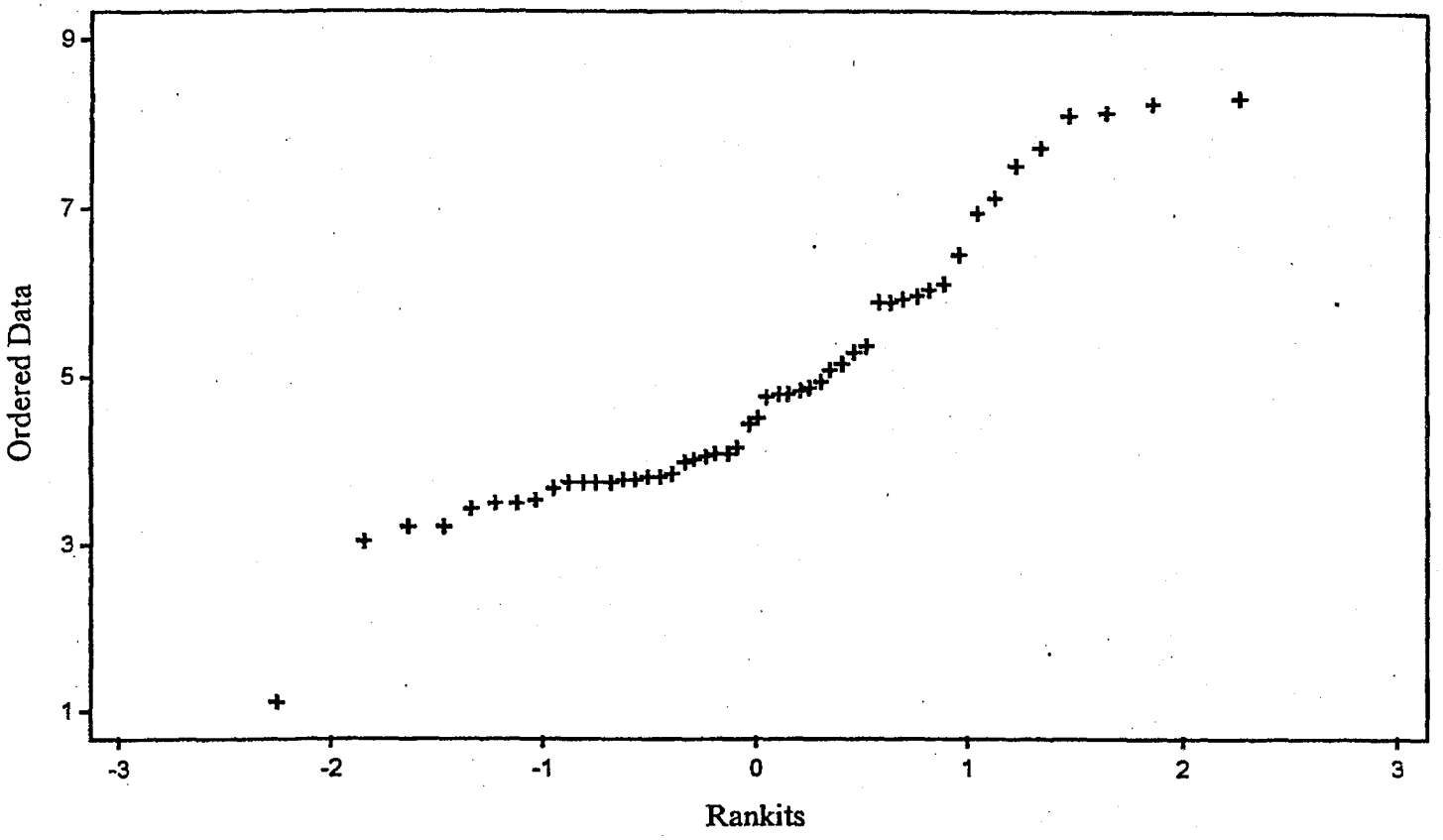
ATTACHMENT

WILKS-SHAPIRO RANK-ITS PLOTS FOR NORMALITY TESTING OF AMBIENT METALS IN GROUNDWATER

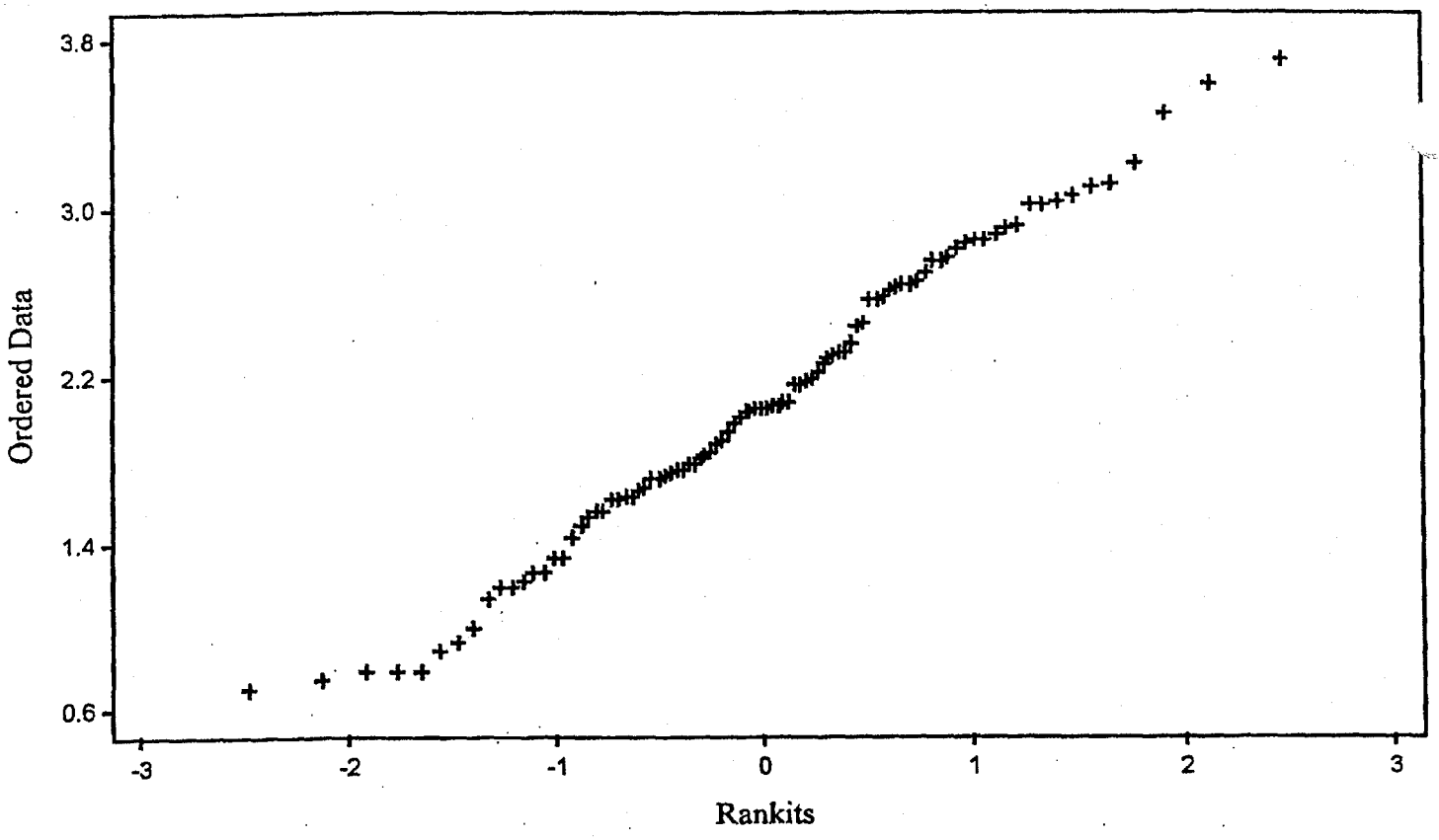
(25 pages)

Plot of LN Aluminum Detections



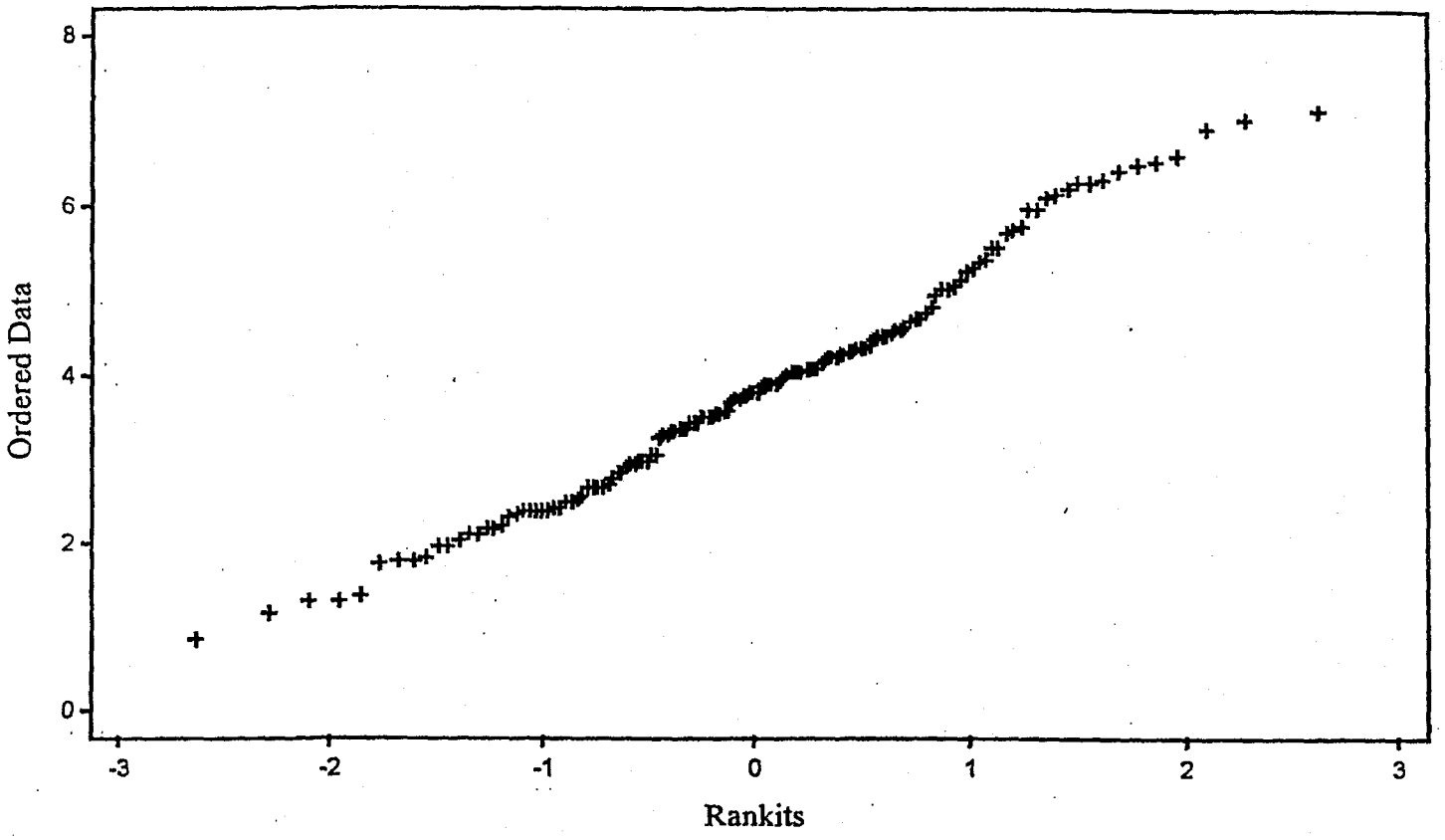
Approximate Wilk-Shapiro 0.9229 51 cases

Plot of LN Arsenic Detections



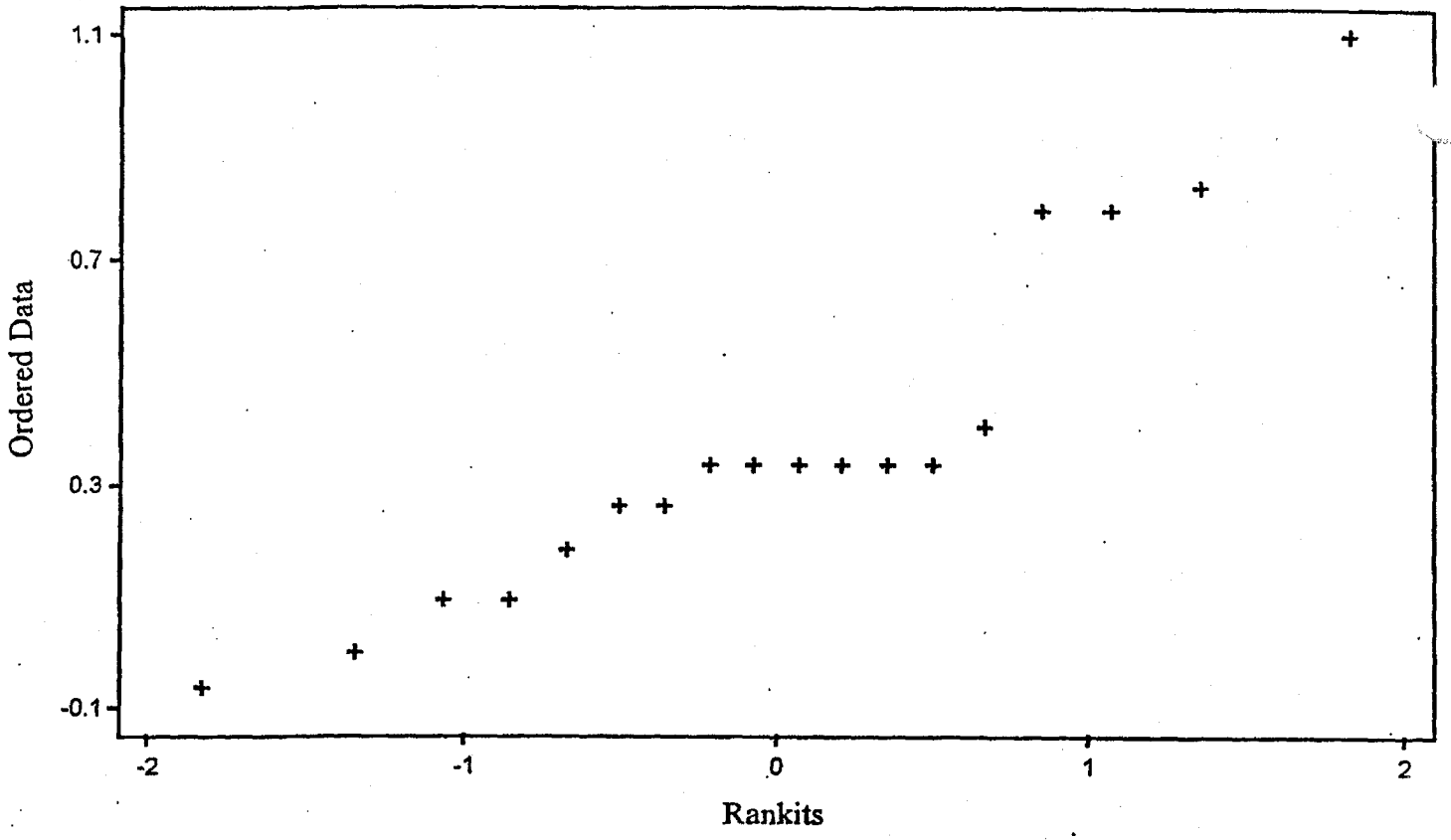
Approximate Wilk-Shapiro 0.9899 94 cases

Plot of LN Barium Detections



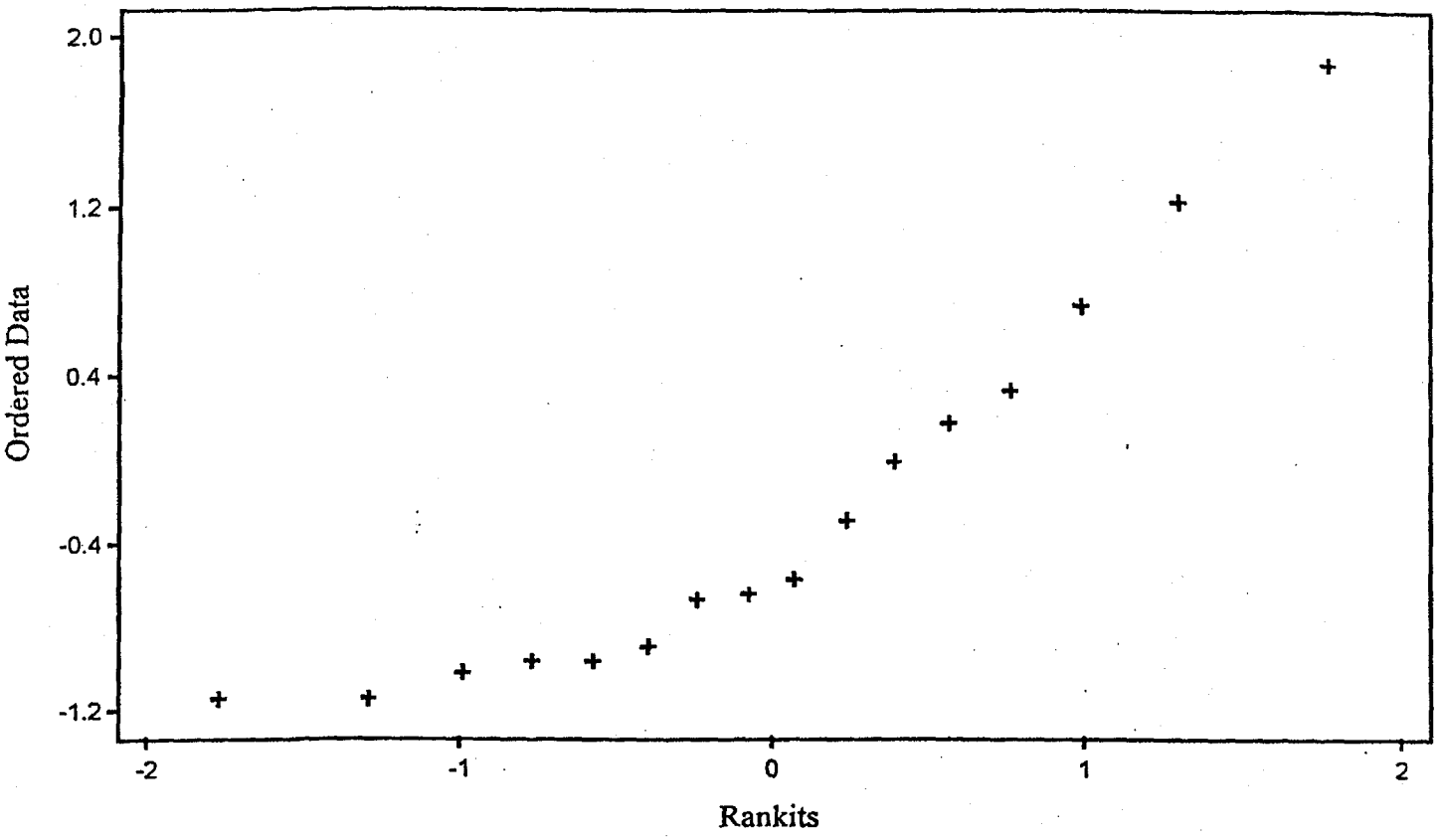
Approximate Wilk-Shapiro 0.9850 144 cases

Plot of LN Beryllium Detections



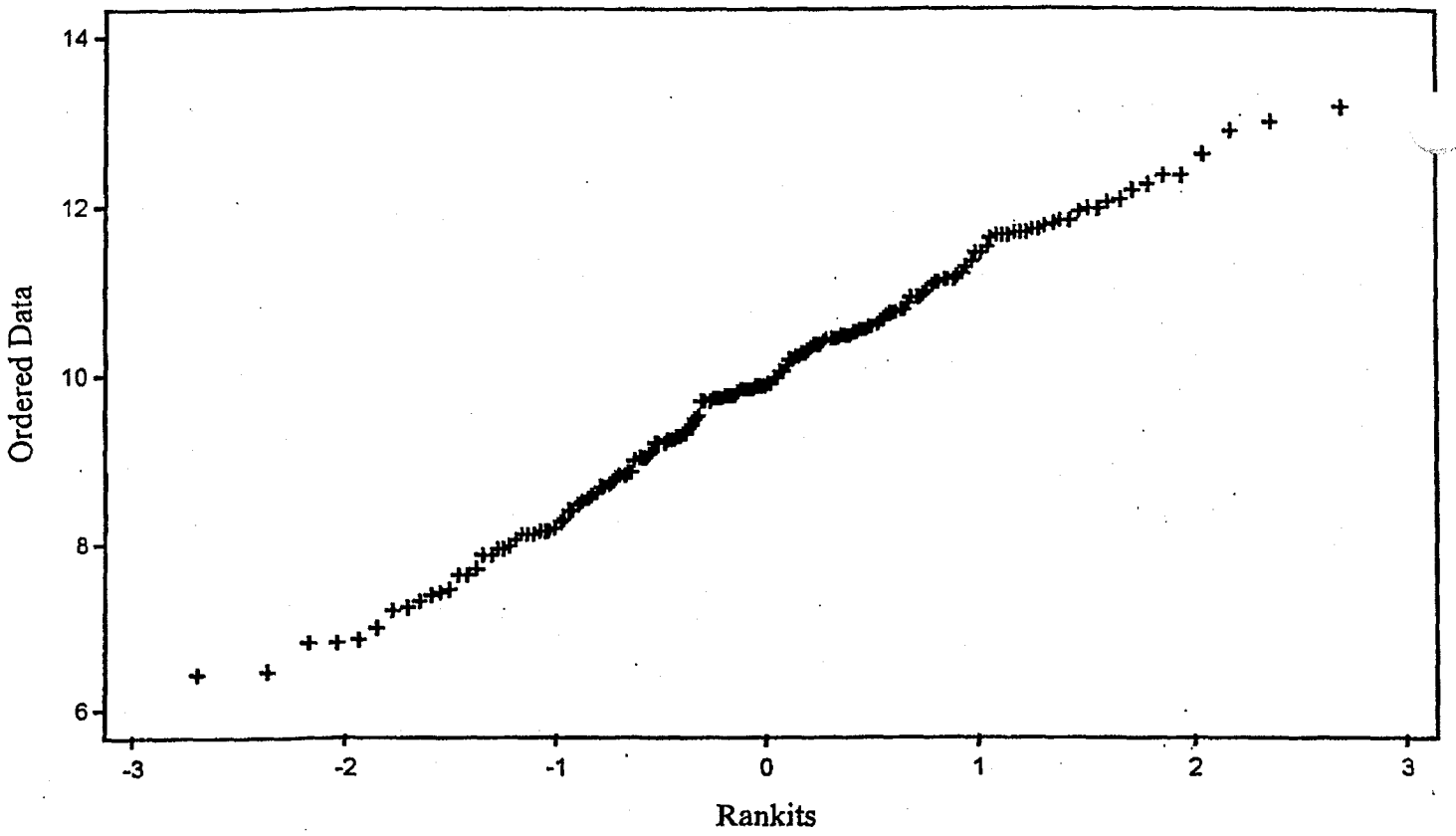
Approximate Wilk-Shapiro 0.8874 18 cases

Plot of LN Cadmium Detections

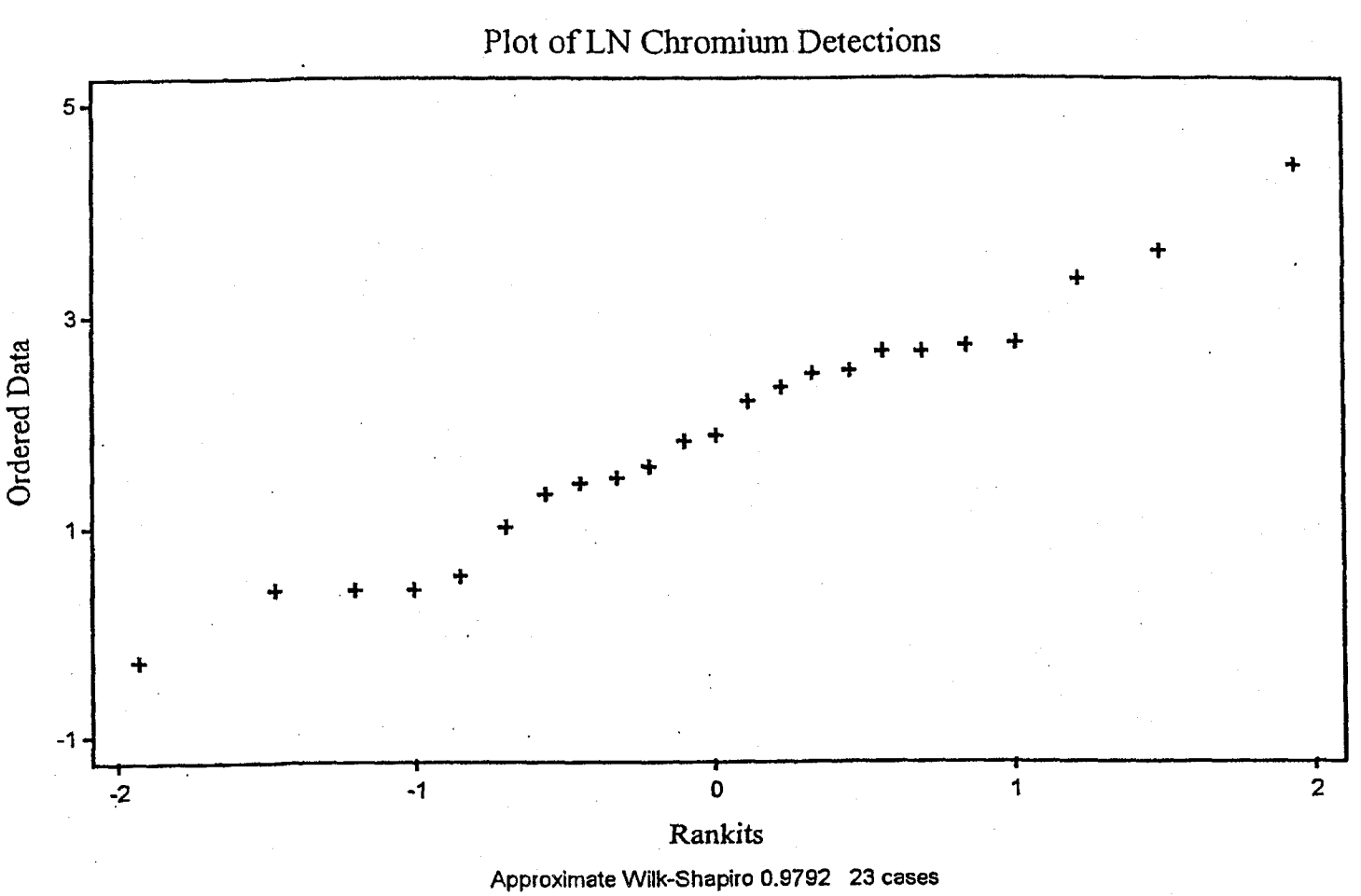


Approximate Wilk-Shapiro 0.8803 16 cases

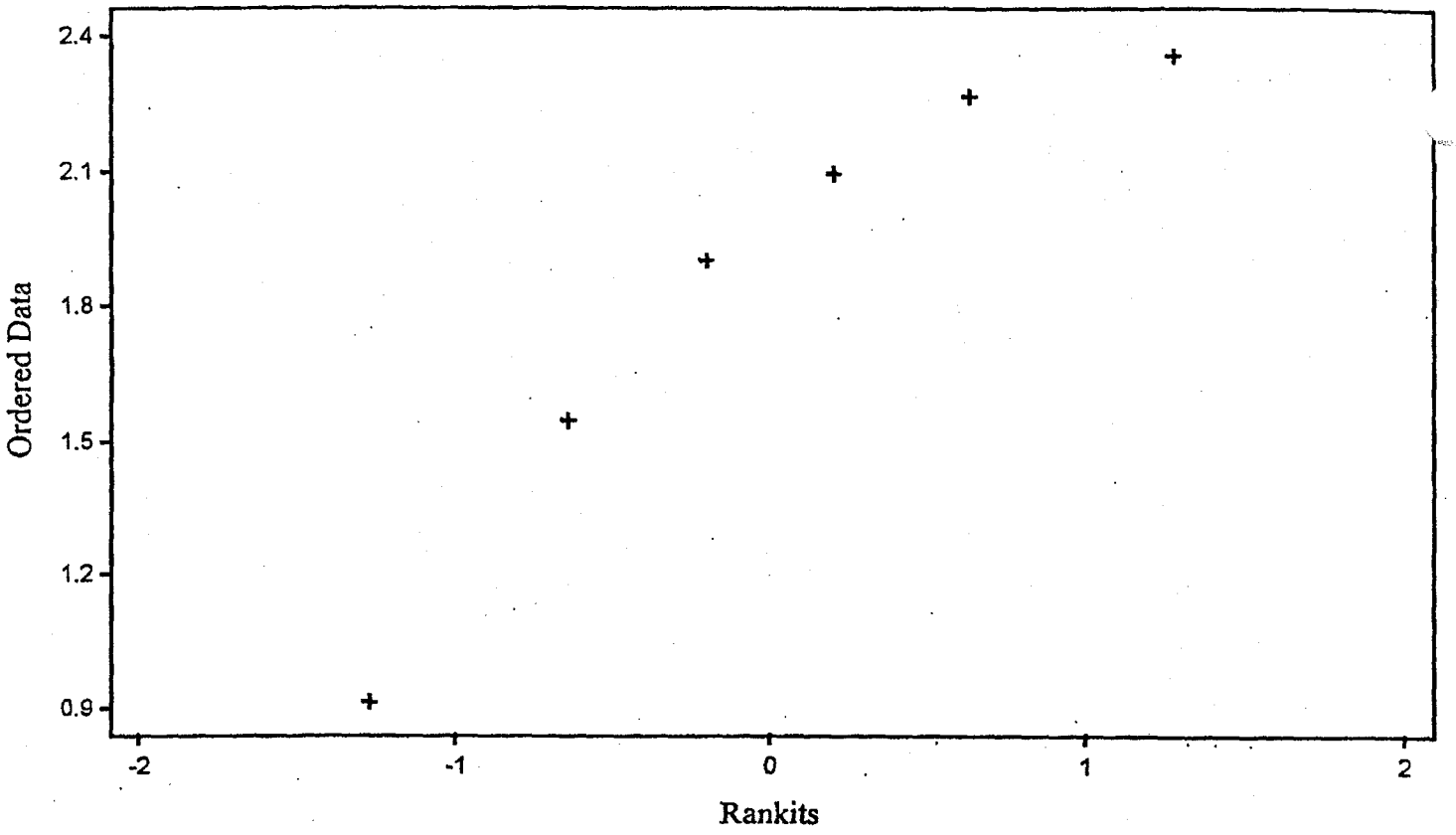
Plot of LN Calcium Detections



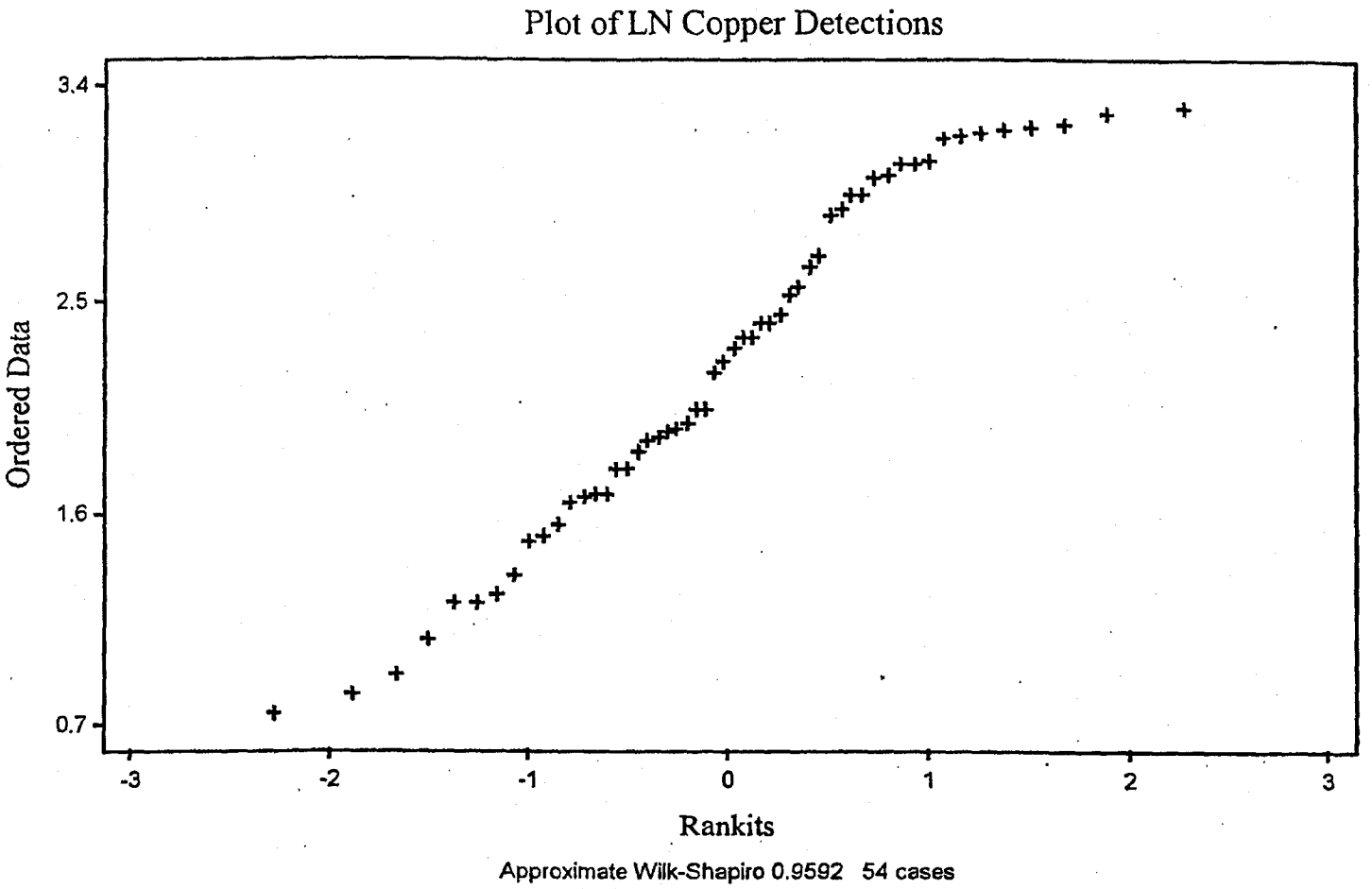
Approximate Wilk-Shapiro 0.9913 176 cases

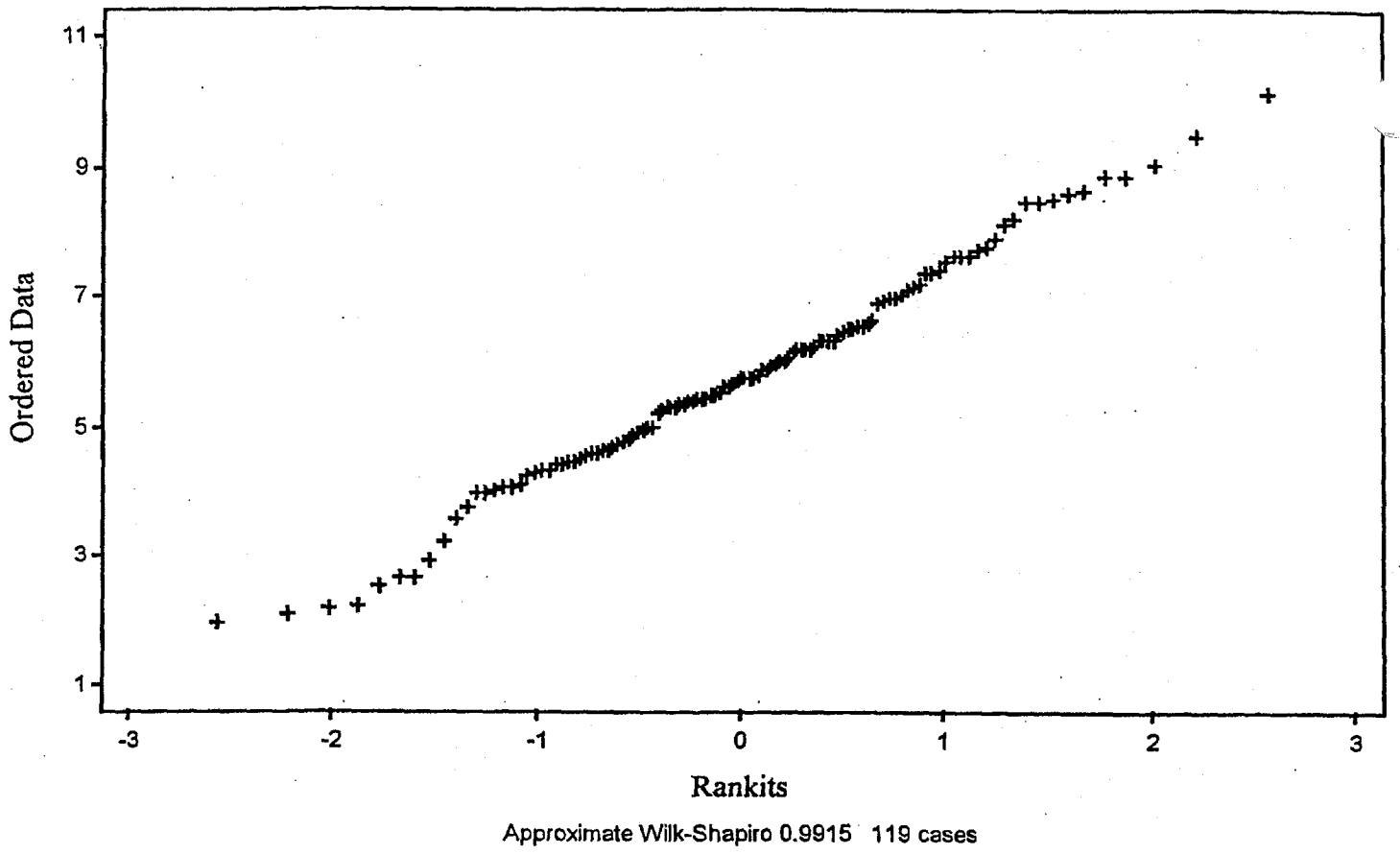

Plot of LN Chromium Detections
Ordered Data
5
3
1
-1
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro 0.9792 23 cases

Plot of LN Cobalt Detections

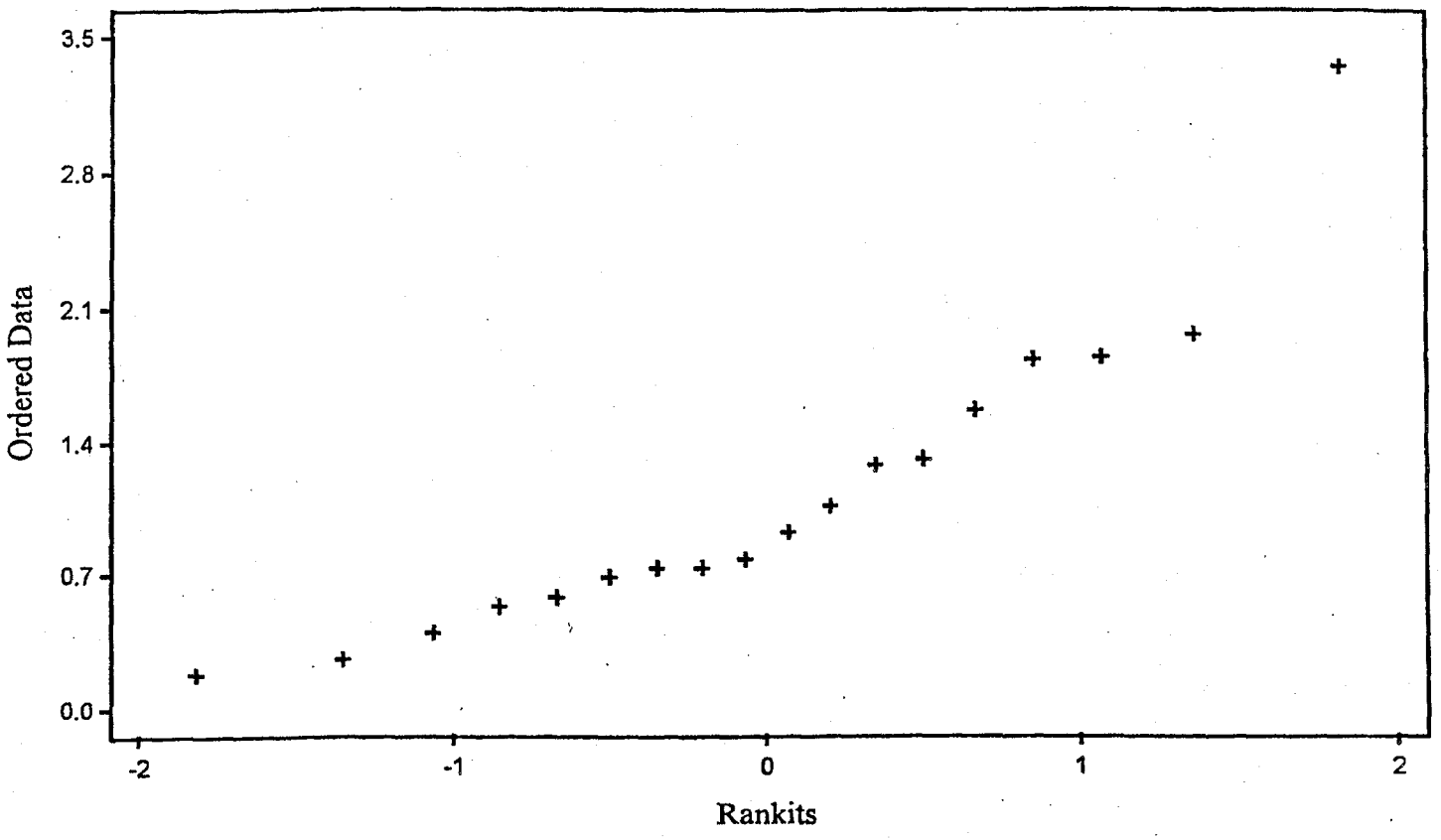


Approximate Wilk-Shapiro 0.9009 6 cases


Plot of LN Copper Detections
Ordered Data
3.4
2.5
1.6
0.7
-3
-2
-1
0
1
2
3
Rankits
Approximate Wilk-Shapiro 0.9592 54 cases

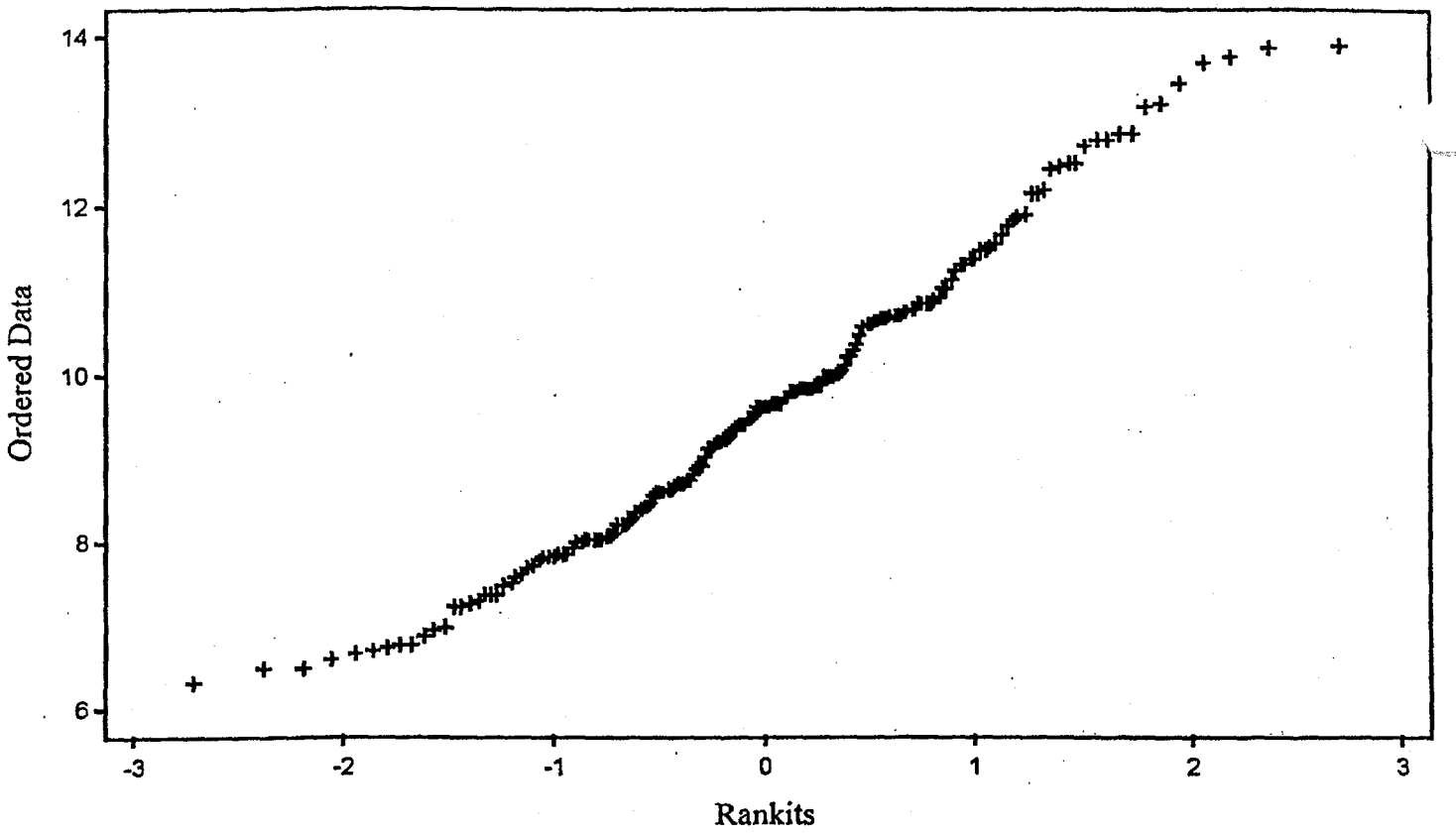

Plot of LN Iron Detections
Ordered Data
11
9
7
5
3
1
-3
-2
-1
0
1
2
3
Rankits
Approximate Wilk-Shapiro 0.9915 119 cases

Plot of LN Lead Detections



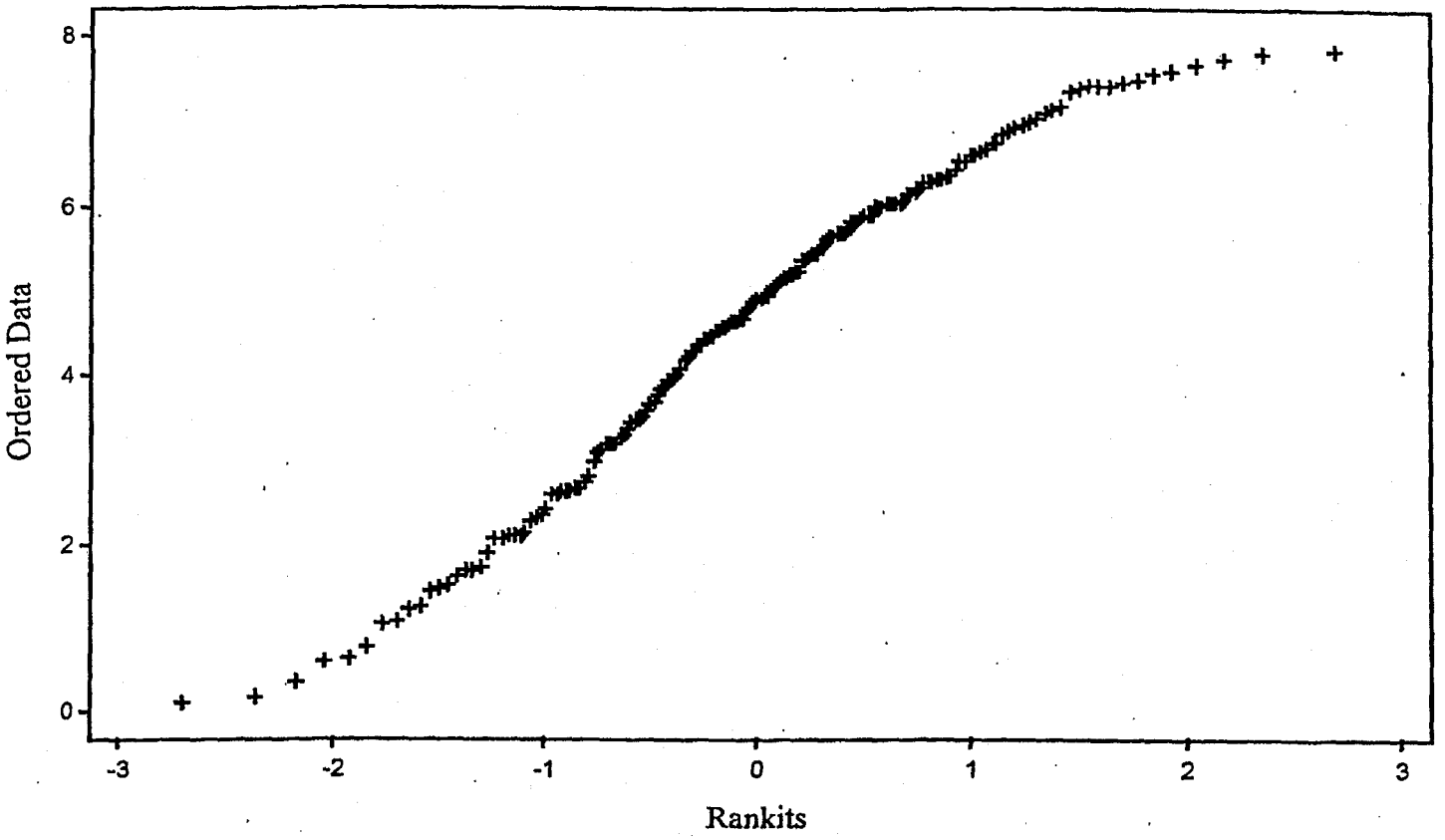
Approximate Wilk-Shapiro 0.8741 18 cases

Plot of LN Magnesium Detections



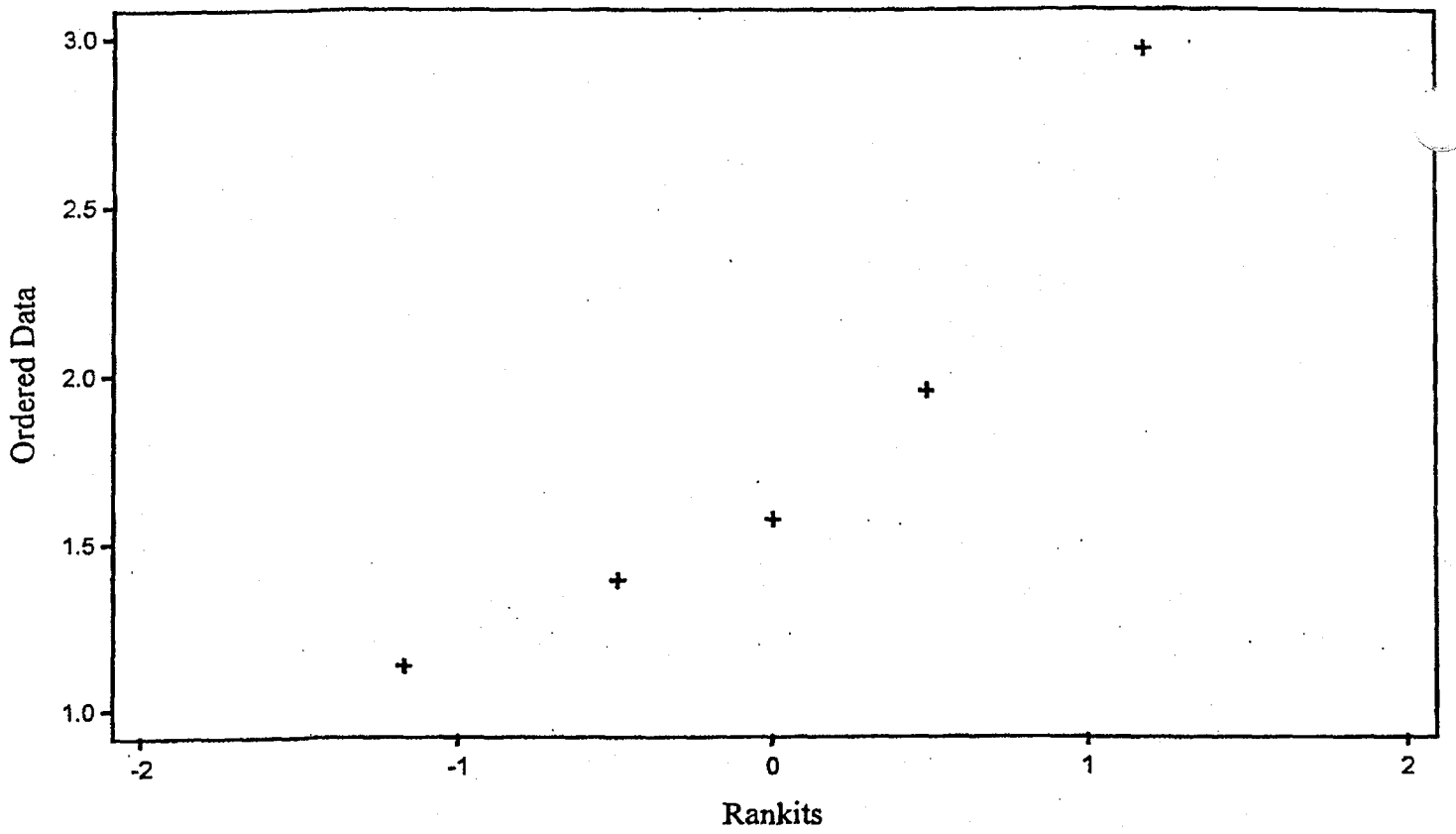
Approximate Wilk-Shapiro 0.9836 180 cases

Plot of LN Manganese Detections



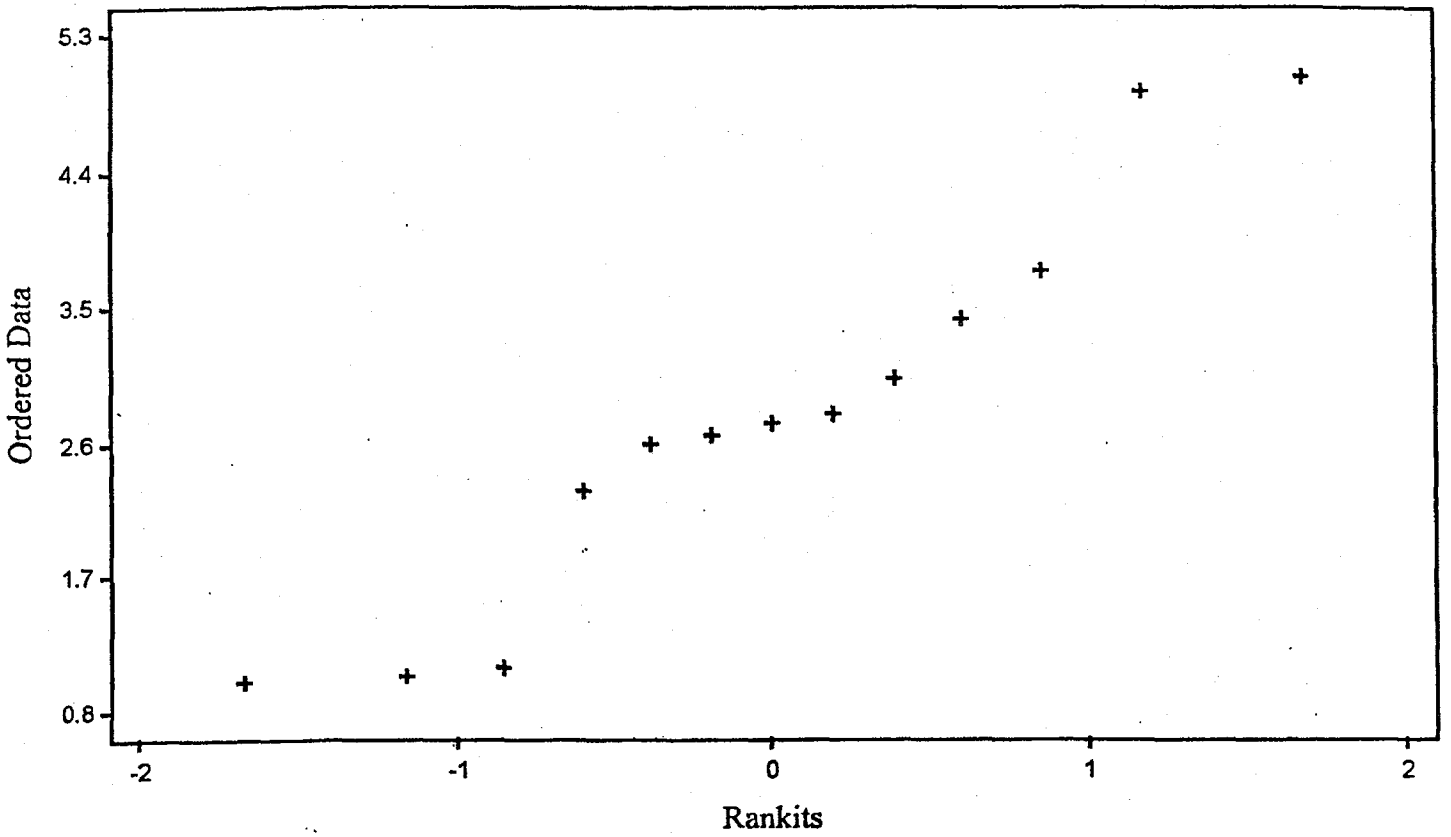
Approximate Wilk-Shapiro 0.9703 172 cases

Plot of LN Molybdenum Detections



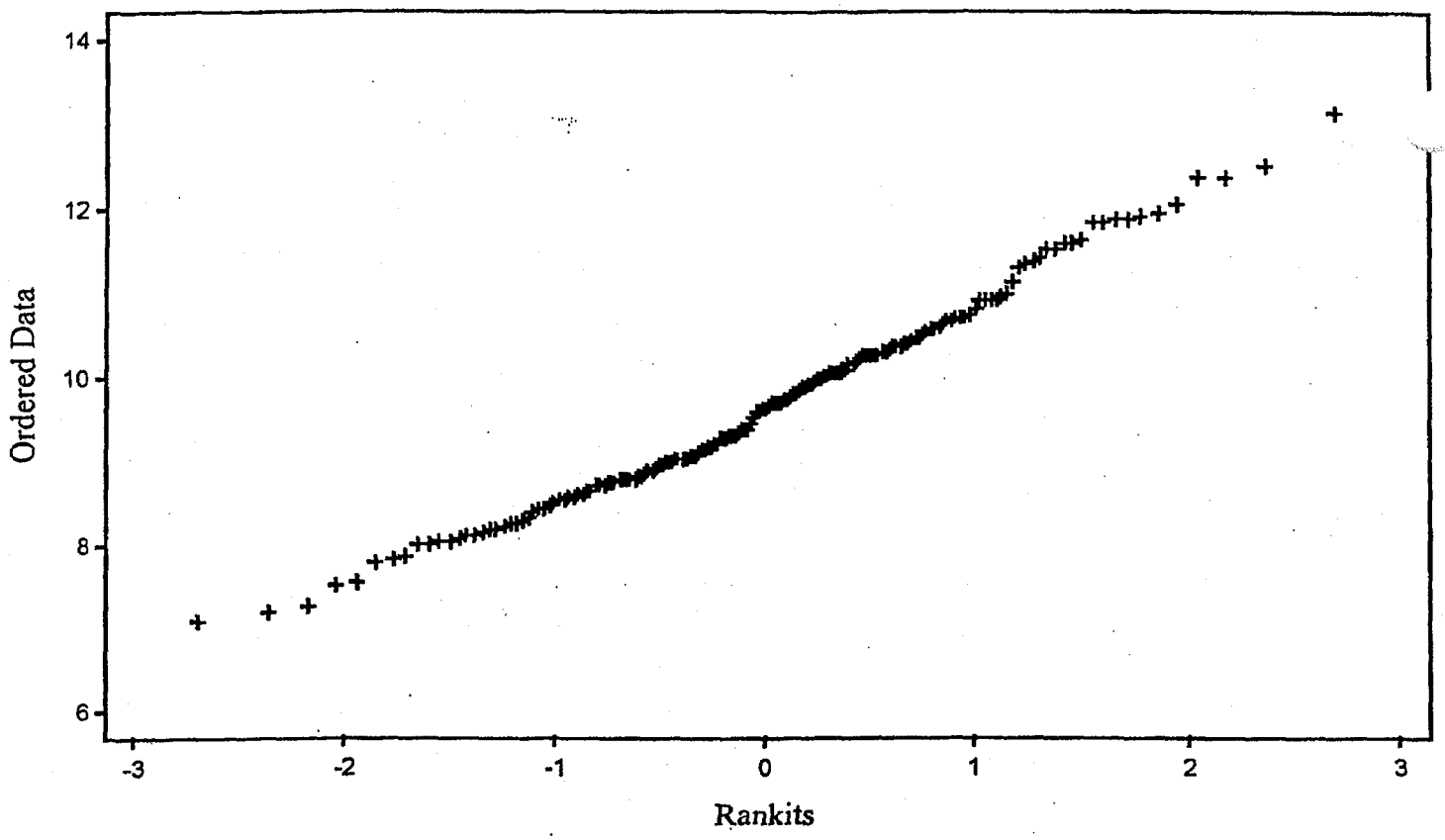
Approximate Wilk-Shapiro 0.8863 5 cases

Plot of LN Nickel Detections



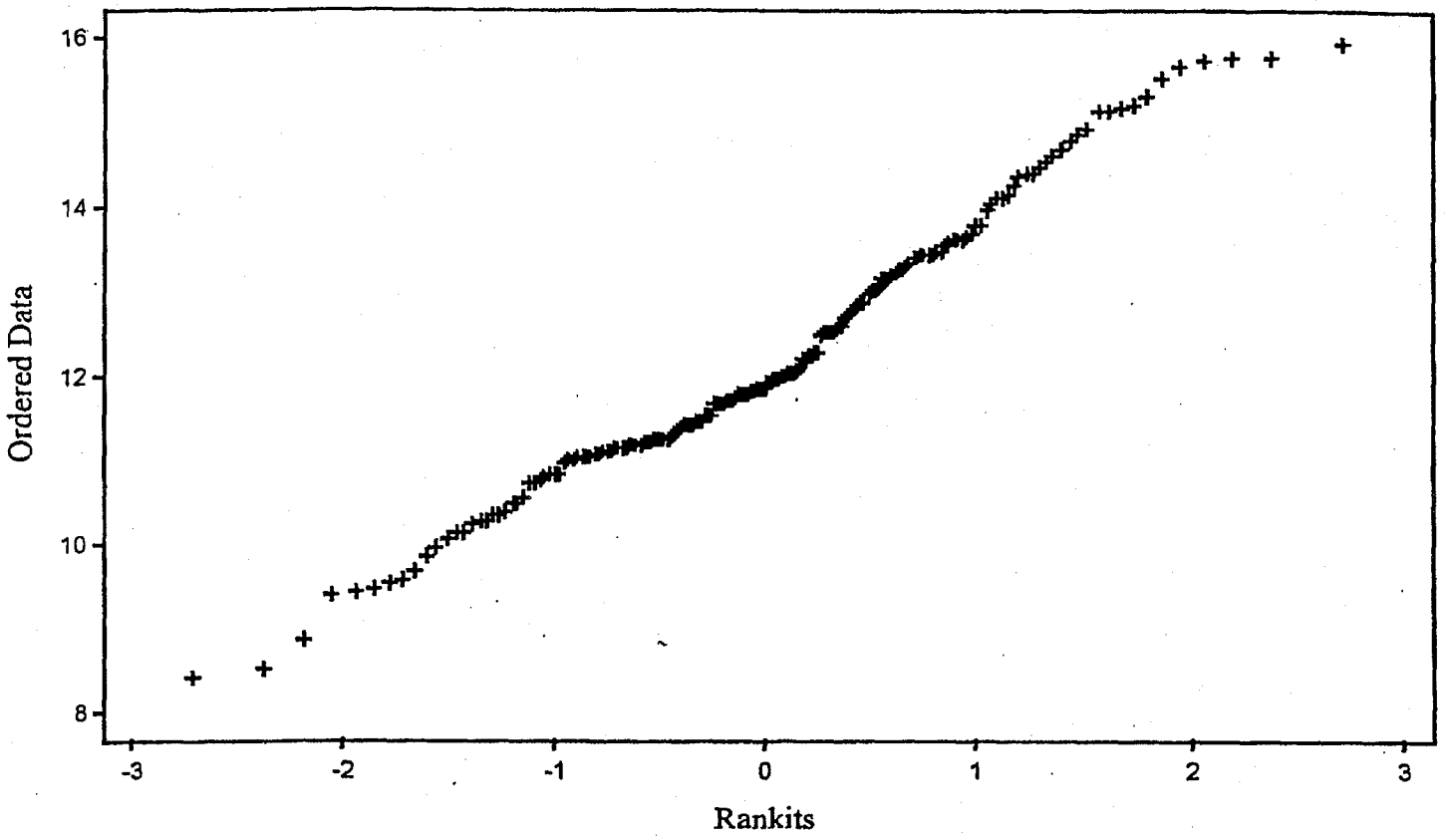
Approximate Wilk-Shapiro 0.9368 13 cases

Plot of LN Potassium Detections



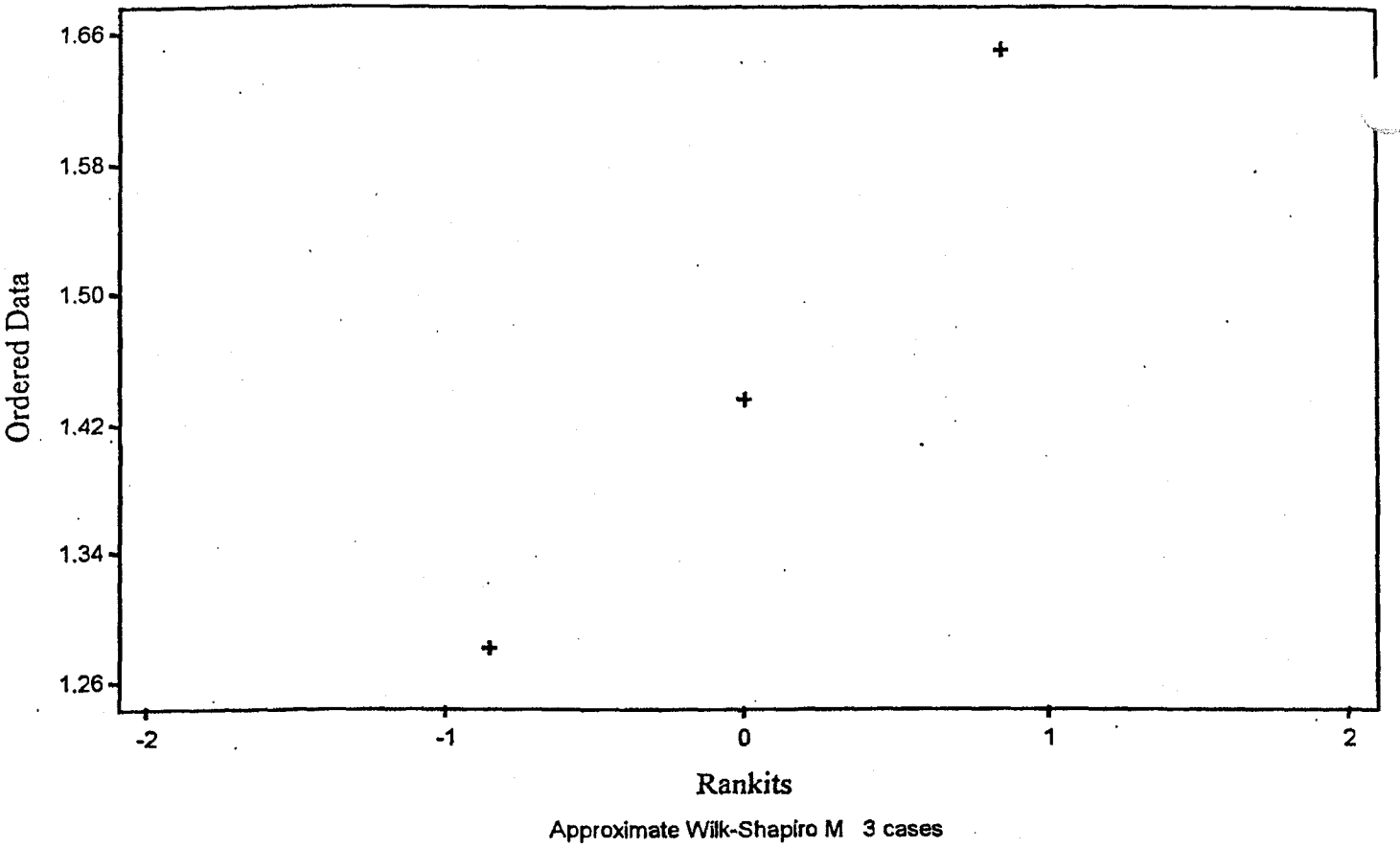
Approximate Wilk-Shapiro 0.9872 175 cases

Plot of LN Sodium Detections



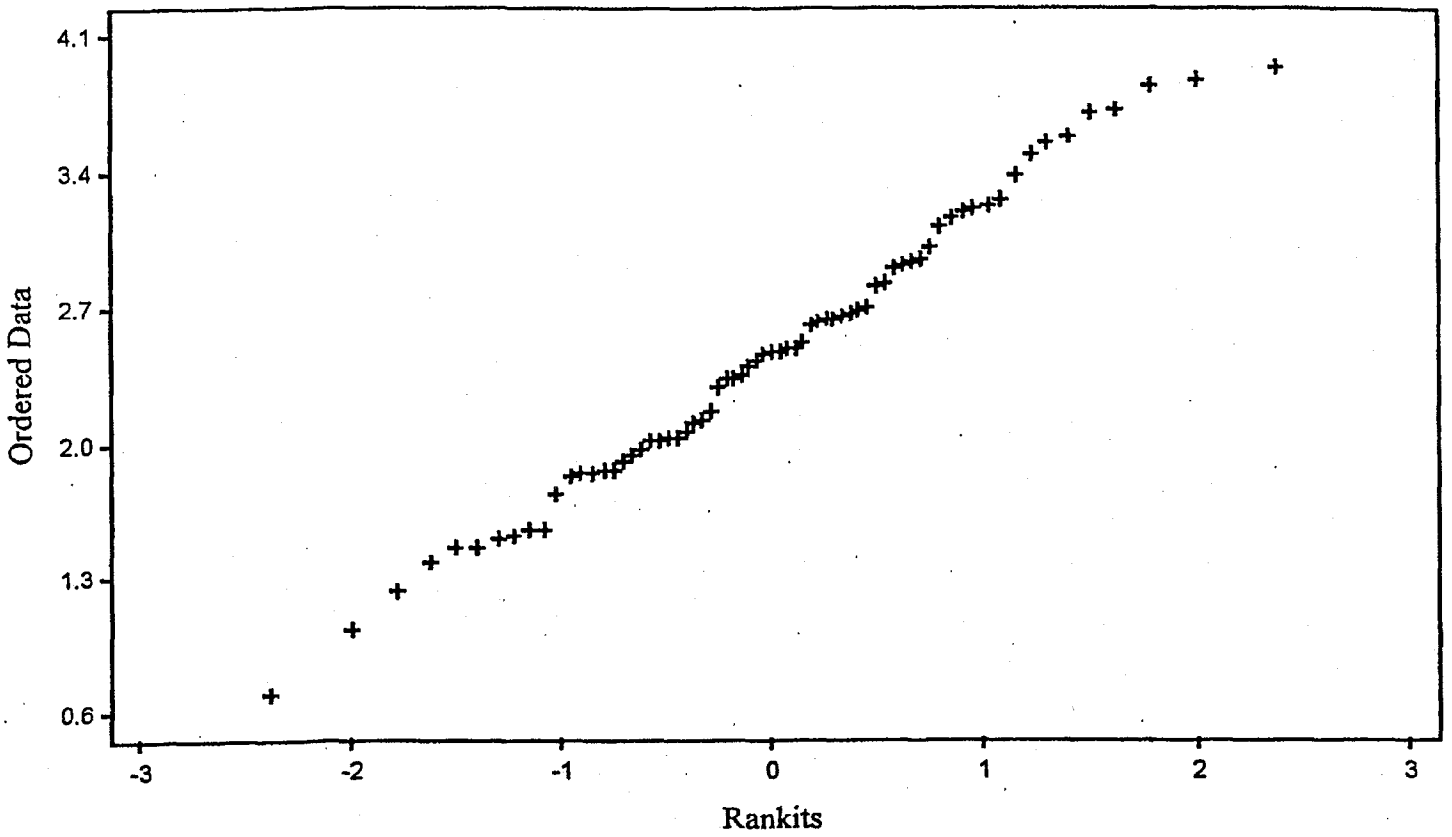
Approximate Wilk-Shapiro 0.9817 180 cases

Plot of LN Thallium Detections



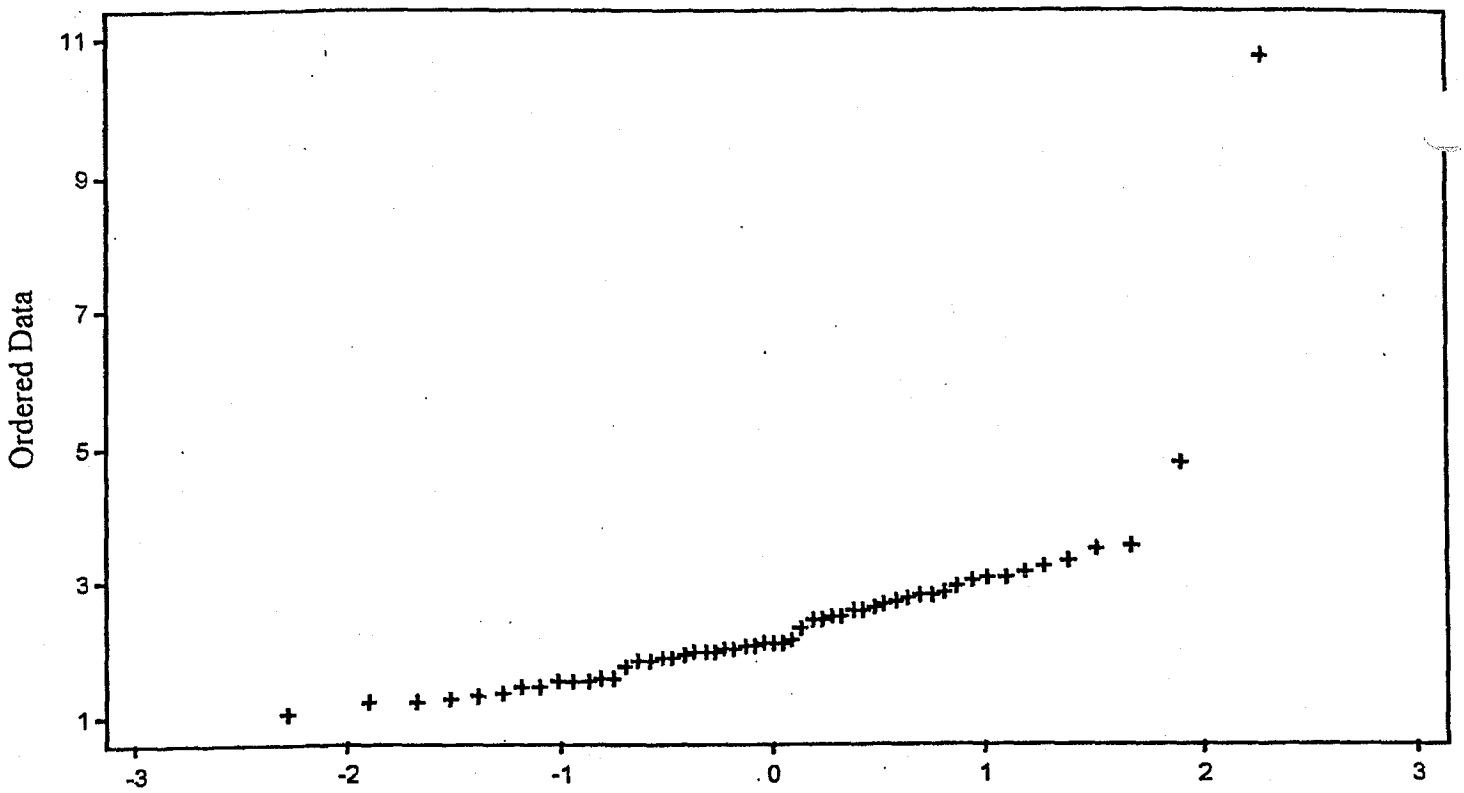
Approximate Wilk-Shapiro M 3 cases

Plot of LN Vanadium Detections

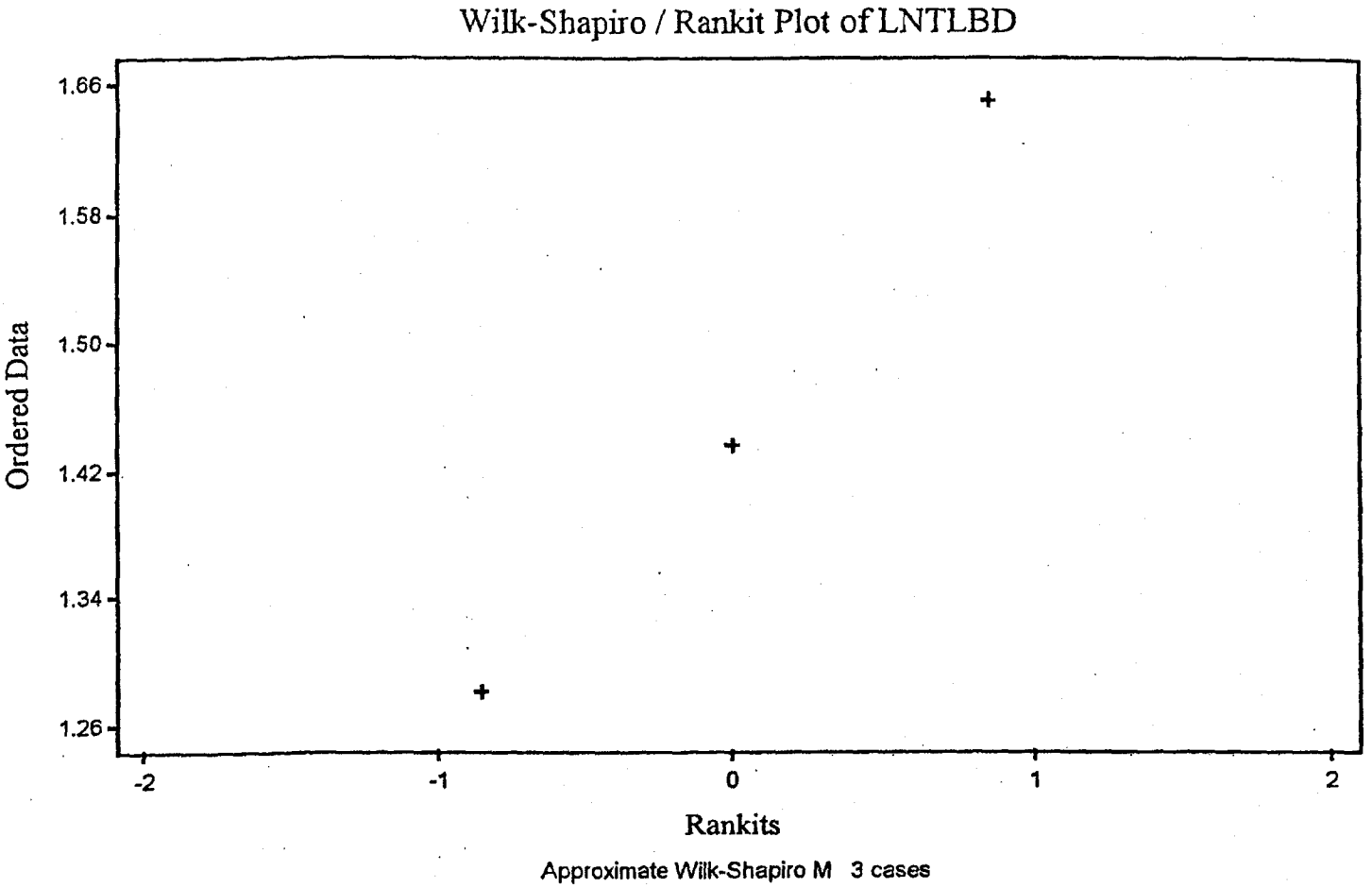


Approximate Wilk-Shapiro 0.9912 69 cases

Plot of LN Zinc Detections



Approximate Wilk-Shapiro 0.5771 55 cases


Wilk-Shapiro / Rankit Plot of LNTLBD
Ordered Data
1.66
1.58
1.50
1.42
1.34
1.26
-2
-1
0
1
2
Rankits
Approximate Wilk-Shapiro M 3 cases

STATISTIX FOR [illegible]

DESCRIPTIVE STATISTICS

	AGB	AGBD	ALB	ALBD	ASB
N	170	2	176	51	179
SSING	10	178	4	129	1
LO 95% CI	1.3530	M	76.640	230.20	5.8885
MEAN	1.4919	3.6000	162.98	511.96	6.9721
UP 95% CI	1.6309	M	249.33	793.72	8.0557
SD	0.9176	1.6971	580.39	1001.8	7.3465
MINIMUM	0.2000	2.4000	3.0000	3.0000	0.9500
MAXIMUM	4.8000	4.8000	3970.0	3970.0	50.000

	ASBD	BAB	BABD	BEB	BEBD
N	94	176	144	176	18
MISSING	86	4	36	4	162
LO 95% CI	8.5706	71.314	85.612	0.6393	1.2612
MEAN	10.084	100.30	120.25	0.7175	1.5300
UP 95% CI	11.597	129.28	154.90	0.7957	1.7988
SD	7.3891	194.81	210.31	0.5259	0.5406
MINIMUM	2.0000	2.1500	2.3000	0.0500	0.9400
MAXIMUM	40.700	1260.0	1260.0	3.0000	3.0000

	BGBD	CAB	CABD	CDB	CDBD
N	3	180	176	176	16
MISSING	177	0	4	4	164
LO 95% CI	0.1232	35884	36734	0.8171	0.3933
MEAN	0.2667	46739	47789	0.9551	1.2581
UP 95% CI	0.4101	57594	58843	1.0931	2.1230
SD	0.0577	73805	74309	0.9276	1.6230
INIMUM	0.2000	449.00	620.00	0.1000	0.3200
AXIMUM	0.3000	513000	513000	6.5000	6.5000

	COB	COBD	CR6B	CR6BD	CRB
N	176	6	3	1	176
MISSING	4	174	177	179	4
LO 95% CI	3.8049	3.8388	-31.307	M	2.1031
MEAN	4.2031	7.0167	34.667	4.0000	3.2054
UP 95% CI	4.6013	10.195	100.64	M	4.3077
SD	2.6767	3.0281	26.558	M	7.4096
MINIMUM	1.1500	2.5000	4.0000	4.0000	0.3000
MAXIMUM	10.500	10.500	50.000	4.0000	82.800

	CRBD	CUB	CUBD	FEB	FEBD
N	23	176	54	180	119
MISSING	157	4	126	0	61
LO 95% CI	4.8949	5.2723	9.7983	448.37	678.96
MEAN	12.541	6.2557	11.950	800.75	1199.8
UP 95% CI	20.187	7.2390	14.102	1153.1	1720.7
SD	17.681	6.6101	7.8833	2395.8	2869.3
MINIMUM	0.7400	0.2000	2.1000	2.4000	7.2000
MAXIMUM	82.800	34.850	27.300	24400	24400

	HGB	KB	KBD	LNAGB	LNAGBD
N	180	180	175	170	2
MISSING	0	0	5	10	178
LO 95% CI	0.0970	23982	24680	0.0517	M
MEAN	0.1007	32184	33080	0.1629	1.2220
UP 95% CI	0.1044	40386	41480	0.2740	M
SD	0.0252	55764	56302	0.7342	0.4901
MINIMUM	0.0500	381.50	1200.0	-1.6094	0.8755

	LNALB	LNALBD	LNASB	LNASBD	LNBAB
N	176	51	179	94	176
MISSING	4	129	1	86	4
LO 95% CI	3.2751	4.4439	1.3833	1.9323	3.3179
MEAN	3.4696	4.8890	1.5186	2.0748	3.5281
UP 95% CI	3.6641	5.3341	1.6538	2.2174	3.7383
SD	1.3076	1.5825	0.9168	0.6961	1.4129
MINIMUM	1.0986	1.0986	-0.0513	0.6931	0.7655
MAXIMUM	8.2865	8.2865	3.9120	3.7062	7.1389

	LNBABD	LNBEB	LNBEBD	LNBGBD	LNCAB
N	144	176	18	3	180
MISSING	36	4	162	177	0
LO 95% CI	3.6047	-0.8645	0.2218	-1.9207	9.5659
MEAN	3.8291	-0.7117	0.3760	-1.3391	9.7906
UP 95% CI	4.0535	-0.5589	0.5303	-0.7576	10.015
SD	1.3622	1.0272	0.3102	0.2341	1.5277
MINIMUM	0.8329	-2.9957	-0.0619	-1.6094	6.1070
MAXIMUM	7.1389	1.0986	1.0986	-1.2040	13.148

	LNCABD	LNCDB	LNCDBD	LNCOB	LNCOBD
N	176	176	16	176	6
MISSING	4	4	164	4	174
LO 95% CI	9.6537	-0.8000	-0.7280	1.1626	1.2809
MEAN	9.8695	-0.6282	-0.2456	1.2516	1.8452
UP 95% CI	10.085	-0.4563	0.2369	1.3407	2.4094
SD	1.4508	1.1552	0.9054	0.5986	0.5376
MINIMUM	6.4297	-2.3026	-1.1394	0.1398	0.9163
MAXIMUM	13.148	1.8718	1.8718	2.3514	2.3514

	LNCRB	LNCRBD	LNCUB	LNCUBD	LNFEB
N	176	23	176	54	180
MISSING	4	157	4	126	0
LO 95% CI	0.2717	1.3852	1.2355	2.0368	4.3797
MEAN	0.4345	1.8886	1.3794	2.2378	4.6875
UP 95% CI	0.5974	2.3920	1.5232	2.4387	4.9953
SD	1.0949	1.1641	0.9671	0.7363	2.0926
MINIMUM	-1.2040	-0.3011	-1.6094	0.7419	0.8755
MAXIMUM	4.4164	4.4164	3.5511	3.3069	10.102

	LNFEBD	LNHGB	LNKB	LNKBD	LNMGBD
N	119	180	180	175	180
MISSING	61	0	0	5	0
LO 95% CI	5.4601	-2.3459	9.3819	9.4768	9.3645
MEAN	5.7601	-2.3167	9.5690	9.6534	9.6219
UP 95% CI	6.0601	-2.2874	9.7560	9.8299	9.8794
SD	1.6528	0.1986	1.2718	1.1833	1.7504
MINIMUM	1.9741	-2.9957	5.9441	7.0901	6.3081
MAXIMUM	10.102	-1.2040	13.132	13.132	13.883

	LNMNB	LNMNBD	LNMOB	LNMOBD	LNNABD
N	180	172	100	5	180
MISSING	0	8	80	175	0
LO 95% CI	4.1527	4.3456	1.4322	0.9104	11.971
MEAN	4.4545	4.6332	1.5235	1.7995	12.201
UP 95% CI	4.7564	4.9207	1.6149	2.6886	12.431
SD	2.0522	1.9107	0.4604	0.7160	1.5637
MINIMUM	-0.5978	0.0953	0.0000	1.1314	8.4338
MAXIMUM	7.8160	7.8160	2.9653	2.9653	15.915

	180	13	180	18	176
MISSING	0	167	0	162	4
LO 95% CI	1.6319	2.0059	-0.2029	0.7262	1.6105
MEAN	1.7221	2.7937	-0.0960	1.1136	1.7638
UP 95% CI	1.8122	3.5816	0.0108	1.5010	1.9170
	0.6127	1.3038	0.7265	0.7791	1.0299
MINIMUM	-0.1625	0.9933	-0.9163	0.1823	0.0000
MAXIMUM	5.0173	5.0173	3.3464	3.3464	3.8670

	LNSBBD	LNTLB	LNTLBD	LNVAB	LNVABD
N	12	175	3	180	69
MISSING	168	5	177	0	111
LO 95% CI	1.2856	0.3717	0.9962	1.4747	2.2807
MEAN	1.9419	0.4680	1.4549	1.6035	2.4564
UP 95% CI	2.5981	0.5642	1.9136	1.7323	2.6321
SD	1.0329	0.6452	0.1847	0.8758	0.7314
MINIMUM	0.9163	-0.1625	1.2809	-0.3567	0.6931
MAXIMUM	3.8670	3.6376	1.6487	3.9279	3.9279

	LNZNB	LNZNBD	MGBD	MNB	MNBD
N	180	55	180	180	172
MISSING	0	125	0	0	8
LO 95% CI	1.4230	2.0423	46191	271.06	284.33
MEAN	1.5830	2.4090	71357	348.27	364.35
UP 95% CI	1.7430	2.7757	96524	425.49	444.37
SD	1.0880	1.3566	171107	525.00	531.67
MINIMUM	-1.3863	1.0296	549.00	0.5500	1.1000
MAXIMUM	10.754	10.754	1.070E+06	2480.0	2480.0

	MOB	MOBD	NABD	NIB	NIBD
	100	5	180	180	13
SSING	80	175	0	0	167
LO 95% CI	4.5822	-0.6839	488431	5.4795	5.3274
MEAN	5.0130	7.6600	692808	7.7119	35.392
UP 95% CI	5.4438	16.004	897184	9.9443	65.457
SD	2.1712	6.7200	1.390E+06	15.178	49.752
MINIMUM	1.0000	3.1000	4600.0	0.8500	2.7000
MAXIMUM	19.400	19.400	8.160E+06	151.00	151.00

	PBB	PBBD	SBB	SBBD	SEB
N	180	18	176	12	180
MISSING	0	162	4	168	0
LO 95% CI	1.0269	1.4225	8.0028	2.4948	1.2588
MEAN	1.4150	4.5222	9.1710	12.467	1.5814
UP 95% CI	1.8031	7.6220	10.339	22.439	1.9040
SD	2.6386	6.2333	7.8530	15.695	2.1933
MINIMUM	0.4000	1.2000	1.0000	2.5000	0.9500
MAXIMUM	28.400	28.400	47.800	47.800	27.000

	SEBD	TLB	TLBD	VAB	VABD
N	1	175	3	180	69
MISSING	179	5	177	0	111
LO 95% CI	M	1.7082	2.3254	6.4114	12.345
MEAN	2.5000	2.2200	4.3333	7.7758	15.125
UP 95% CI	M	2.7318	6.3412	9.1403	17.904
SD	M	3.4307	0.8083	9.2769	11.570
INIMUM	2.5000	0.8500	3.6000	0.7000	2.0000
MAXIMUM	2.5000	38.000	5.2000	50.800	50.800

	ZNB	ZNBD
N	180	55

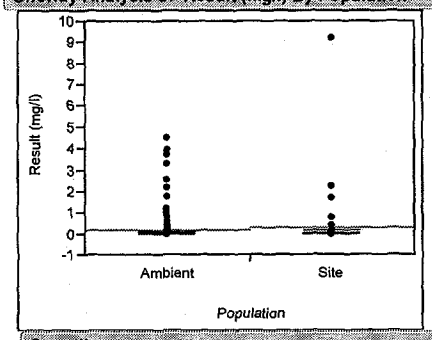
MISSING	-	---
LO 95% CI	-246.12	-841.64
MEAN	266.87	863.86
UP 95% CI	779.85	2569.4
SD	3487.8	6308.8
MINIMUM	0.2500	2.8000
MAXIMUM	46800	46800

ATTACHMENT C
BOX PLOTS

GROUNDWATER BOX PLOTS

Site=GW, Chemical=Aluminum

Oneway Analysis of Result (mg/l) By Population

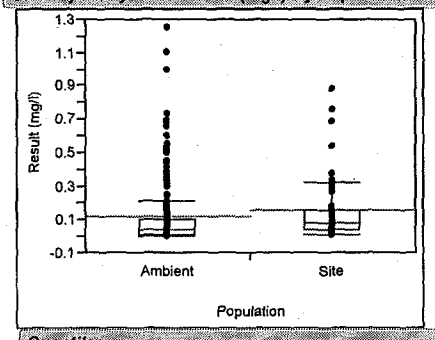


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.003	0.0207	0.0282	0.04075	0.066675	0.2545	4.53
Site	0.0046	0.0064	0.011	0.0424	0.1	0.22	9.22

Site=GW, Chemical=Barium

Oneway Analysis of Result (mg/l) By Population

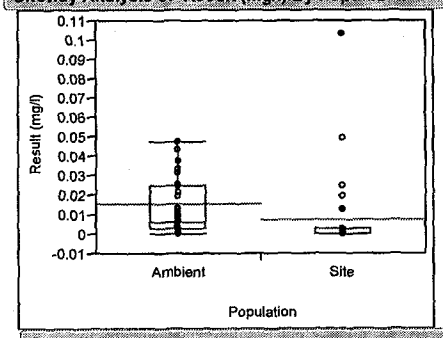


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0023	0.00875	0.0151	0.0425	0.10625	0.389	1.26
Site	0.0161	0.035	0.0448	0.085	0.16	0.38	0.88

Site=GW, Chemical=Antimony

Oneway Analysis of Result (mg/l) By Population

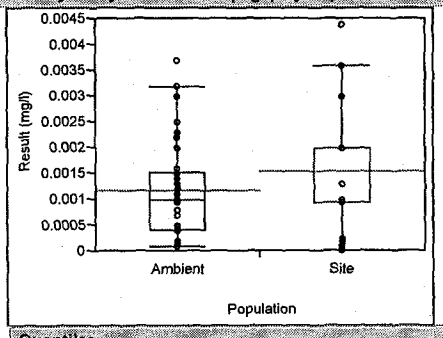


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00065	0.002	0.0033	0.0065	0.0251	0.0375	0.0478
Site	0.000049	0.000091	0.000165	0.0004	0.00275	0.0251	0.104

Site=GW, Chemical=Beryllium

Oneway Analysis of Result (mg/l) By Population

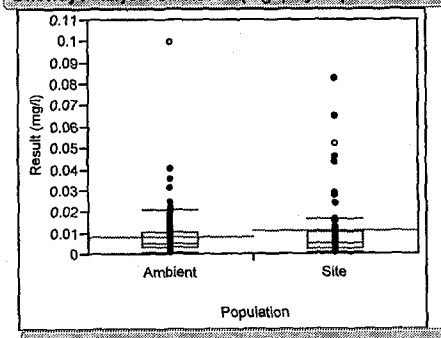


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0001	0.0001	0.000407	0.001	0.001525	0.0025	0.0037
Site	0.000023	0.0001	0.00093	0.002	0.002	0.002	0.0044

Site=GW, Chemical=Arsenic

Oneway Analysis of Result (mg/l) By Population

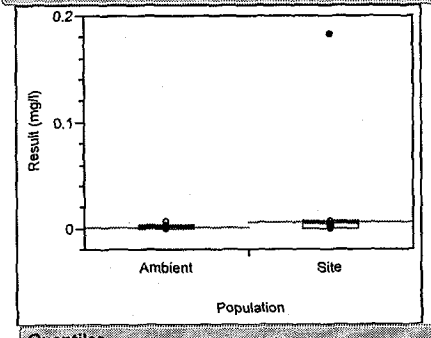


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.001	0.00259	0.0034	0.00525	0.010525	0.01681	0.1
Site	0.0008	0.00168	0.0026	0.005	0.0107	0.03804	0.083

Site=GW, Chemical=Cadmium

Oneway Analysis of Result (mg/l) By Population



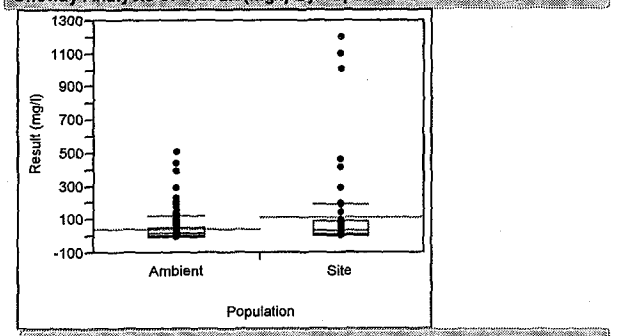
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00015	0.0003	0.0003	0.000555	0.003	0.0039	0.008
Site	0.000055	0.00022	0.000375	0.005	0.005	0.005	0.183

GROUNDWATER BOX PLOTS

Site=GW, Chemical=Calcium

Oneway Analysis of Result (mg/l) By Population

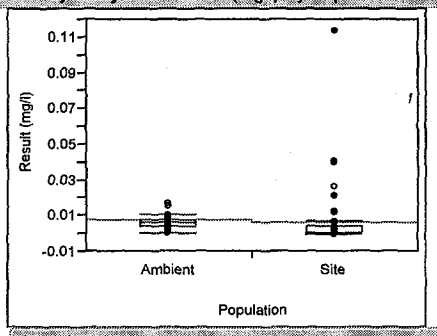


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.62	2.557	6.8375	21.3	52.45	122.3	513
Site	4	7.328	15.3	39	87.3	254	1200

Site=GW, Chemical=Cobalt

Oneway Analysis of Result (mg/l) By Population

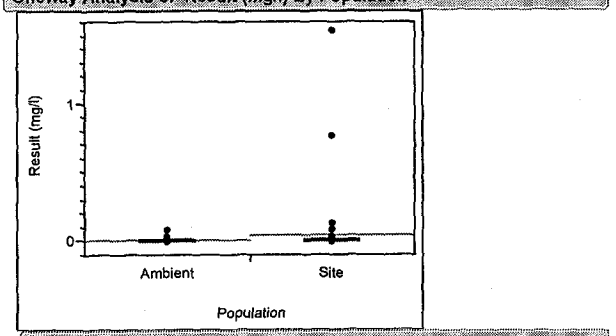


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00025	0.00195	0.0038	0.0061	0.0077	0.0172	0.0172
Site	0.000068	0.00013	0.00024	0.00046	0.0041	0.013	0.114

Site=GW, Chemical=Chromium

Oneway Analysis of Result (mg/l) By Population

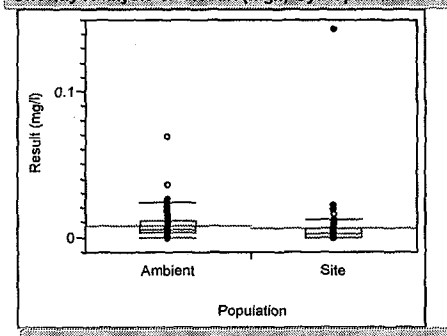


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0002	0.0007	0.001	0.0023	0.0063	0.0063	0.0828
Site	0.0001	0.000429	0.000732	0.00175	0.01	0.02902	1.54

Site=GW, Chemical=Copper

Oneway Analysis of Result (mg/l) By Population

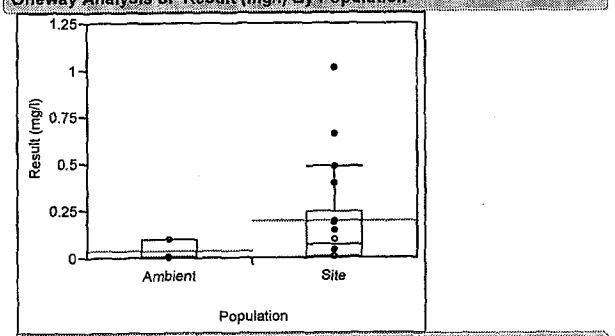


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00035	0.002	0.003725	0.00585	0.012	0.019	0.0697
Site	0.000079	0.000414	0.00061	0.0028	0.0063	0.01238	0.144

Site=GW, Chemical=Chromium(VI)

Oneway Analysis of Result (mg/l) By Population

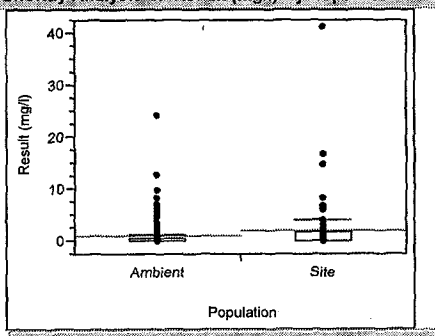


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.004	0.004	0.01	0.01	0.1	0.1	0.1
Site	0.01	0.01	0.01	0.07425	0.25	0.696	1.02

Site=GW, Chemical=Iron

Oneway Analysis of Result (mg/l) By Population



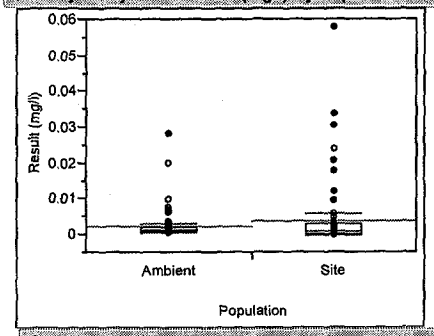
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0048	0.01047	0.031375	0.1305	0.5555	3.736	24.4
Site	0.0083	0.03036	0.061	0.25	1.8	6.342	41.4

GROUNDWATER BOX PLOTS

Site=GW, Chemical=Lead

Oneway Analysis of Result (mg/l) By Population

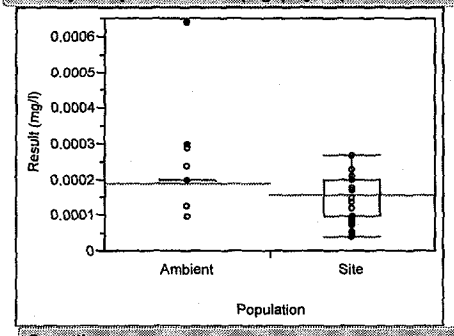


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0005	0.0008	0.0011	0.0013	0.002	0.0025	0.0284
Site	0.000023	0.000054	0.00027	0.000985	0.003	0.00866	0.058

Site=GW, Chemical=Mercury

Oneway Analysis of Result (mg/l) By Population

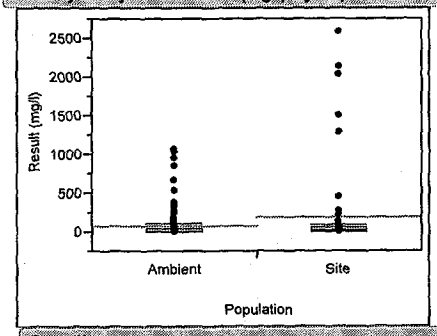


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.00064
Site	0.000041	0.000081	0.0001	0.0002	0.0002	0.0002	0.00027

Site=GW, Chemical=Magnesium

Oneway Analysis of Result (mg/l) By Population

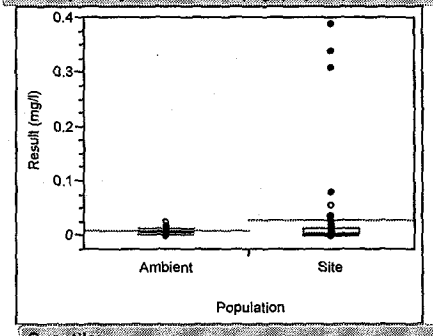


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.549	1.734	4.295	15.15	45.65	186.6	1070
Site	2.24	3.948	11	20	55	385.6	2600

Site=GW, Chemical=Molybdenum

Oneway Analysis of Result (mg/l) By Population

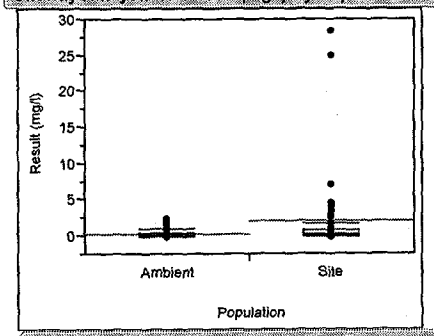


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00025	0.002	0.007	0.0096	0.0098	0.0127	0.0254
Site	0.0005	0.000955	0.002175	0.0036	0.015075	0.047	0.39

Site=GW, Chemical=Manganese

Oneway Analysis of Result (mg/l) By Population

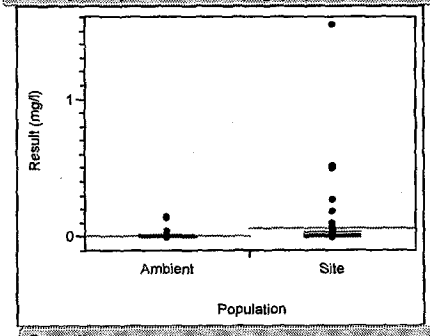


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00078	0.00438	0.021525	0.1315	0.435	1.203	2.48
Site	0.00082	0.01158	0.0694	0.25	0.81	4.304	28.4

Site=GW, Chemical=Nickel

Oneway Analysis of Result (mg/l) By Population



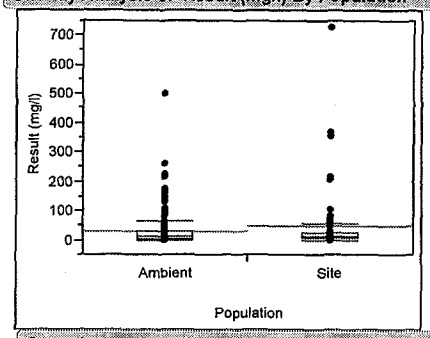
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0007	0.00269	0.0093	0.0113	0.0132	0.0132	0.151
Site	0.00042	0.00156	0.00255	0.005	0.0197	0.1368	1.55

GROUNDWATER BOX PLOTS

Site=GW, Chemical=Potassium

Oneway Analysis of Result (mg/l) By Population

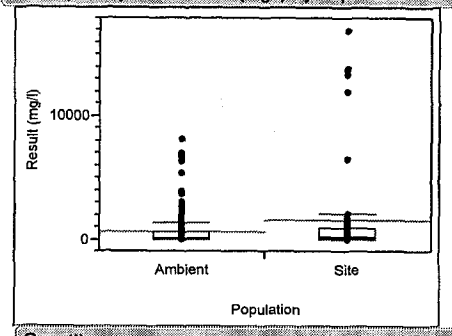


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.763	3.338	6.405	15	32.525	92.32	505
Site	0.91	3.8	7.93	13.9	28	98.4	729

Site=GW, Chemical=Sodium

Oneway Analysis of Result (mg/l) By Population

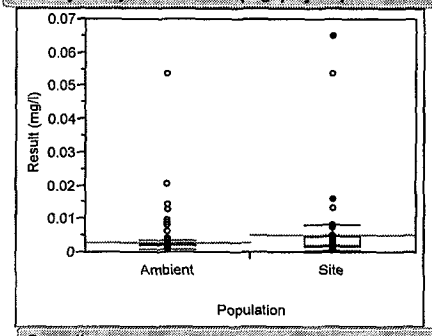


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	4.6	31.22	69.275	140.5	623.5	2044	8160
Site	10.8	31.4	74.7	250	960	4740	17000

Site=GW, Chemical=Selenium

Oneway Analysis of Result (mg/l) By Population

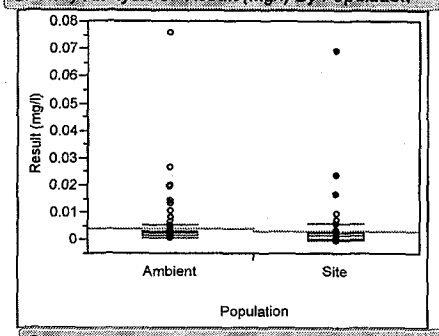


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0008	0.002	0.002	0.0024	0.0027	0.003	0.054
Site	0.0005	0.00089	0.0016	0.0022	0.005	0.0083	0.065

Site=GW, Chemical=Thallium

Oneway Analysis of Result (mg/l) By Population

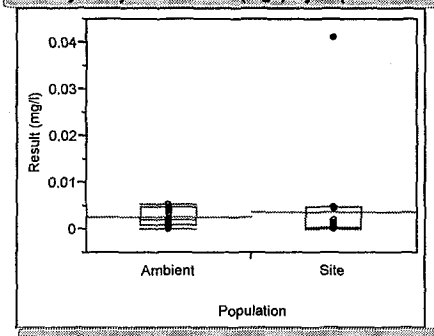


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0009	0.0017	0.0017	0.0027	0.0035	0.00496	0.076
Site	0.000018	0.000059	0.000435	0.002	0.0027	0.00558	0.0692

Site=GW, Chemical=Silver

Oneway Analysis of Result (mg/l) By Population

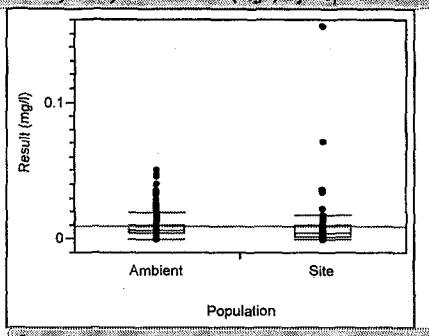


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00015	0.00035	0.0009	0.002	0.0048	0.0049	0.0054
Site	0.000039	0.00014	0.0005	0.005	0.005	0.005	0.0412

Site=GW, Chemical=Vanadium

Oneway Analysis of Result (mg/l) By Population



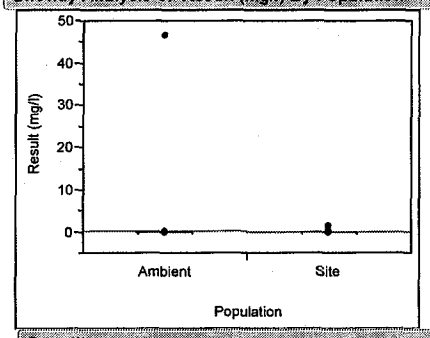
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.00025	0.00368	0.0042	0.007	0.010525	0.01843	0.0508
Site	0.00025	0.000874	0.0019	0.0043	0.0099	0.01712	0.156

GROUNDWATER BOX PLOTS

Site=GW, Chemical=Zinc

Oneway Analysis of Result (mg/l) By Population



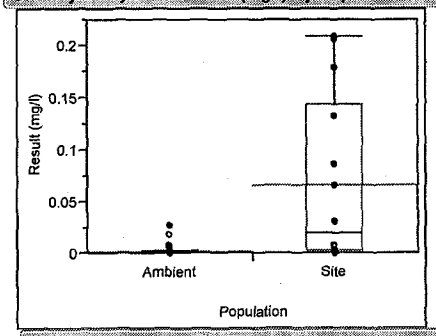
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.0005	0.00319	0.0046	0.00775	0.0131	0.02075	46.8
Site	0.00049	0.00176	0.0054	0.01	0.02	0.08376	1.46

GROUNDWATER BOX PLOTS

Site=Plume, Chemical=Lead

Oneway Analysis of Result (mg/l) By Population



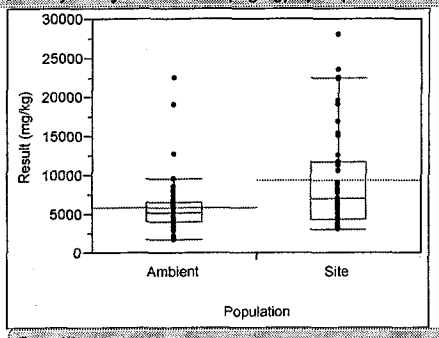
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	*0.0005*	*0.0008*	*0.0011*	*0.0013*	*0.002*	*0.0025*	*0.0284*
Site	0.00065	0.000715	0.00325	0.0206	0.1445	0.2085	0.21

SOIL BOX PLOTS

Site=3, Depth=0-8 ft bgs, Chemical=Aluminum

Oneway Analysis of Result (mg/kg) By Population

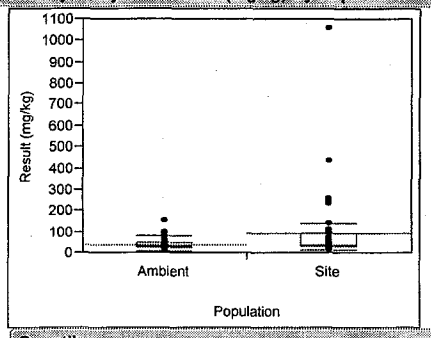


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1760	3244	4010	5230	6570	8282	22600
Site	3130	3798	4495	7110	11700	20720	28100

Site=3, Depth=0-8 ft bgs, Chemical=Barium

Oneway Analysis of Result (mg/kg) By Population

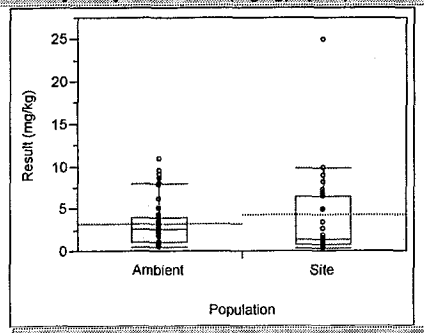


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	6.91	20.6	27.8	32.5	49.2	81.7	156
Site	15.4	23.36	31.5	36.8	93	244.6	1060

Site=3, Depth=0-8 ft bgs, Chemical=Antimony

Oneway Analysis of Result (mg/kg) By Population

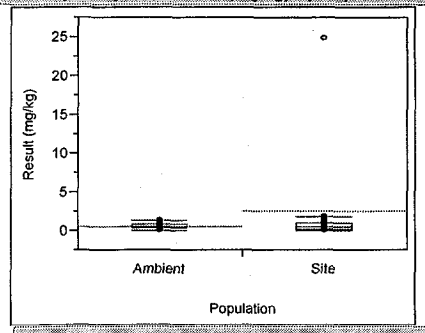


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.46	0.504	1.1	2.6	4	8.6	11
Site	0.44	0.52	0.77	1.4	6.55	9.9	25

Site=3, Depth=0-8 ft bgs, Chemical=Beryllium

Oneway Analysis of Result (mg/kg) By Population

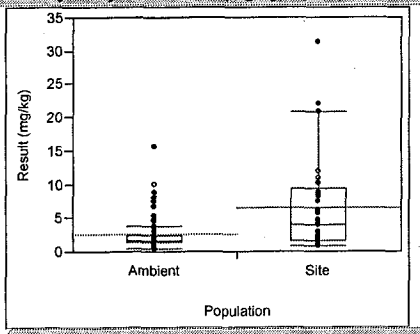


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.15	0.176	0.36	0.576	0.865	1.026	1.47
Site	0.024	0.15	0.265	0.53	1.1	1.9	25

Site=3, Depth=0-8 ft bgs, Chemical=Arsenic

Oneway Analysis of Result (mg/kg) By Population

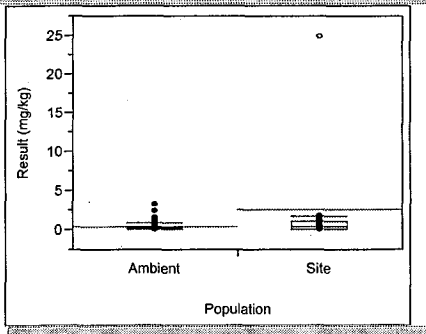


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.435	0.9188	1.4	1.7	2.34	6.956	15.6
Site	0.96	1.32	1.75	4	9.5	15.6	31.5

Site=3, Depth=0-8 ft bgs, Chemical=Cadmium

Oneway Analysis of Result (mg/kg) By Population



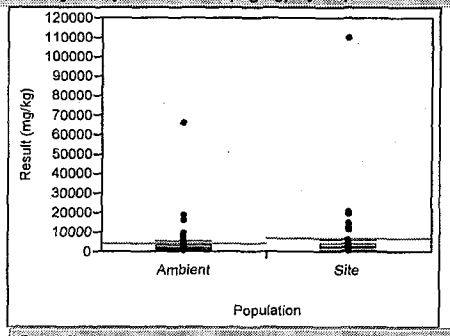
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.08	0.09	0.15	0.325	0.48	0.9922	3.19
Site	0.047	0.06	0.07	0.49	1.15	1.7	25

SOIL BOX PLOTS

Site=3, Depth=0-8 ft bgs, Chemical=Calcium

Oneway Analysis of Result (mg/kg) By Population

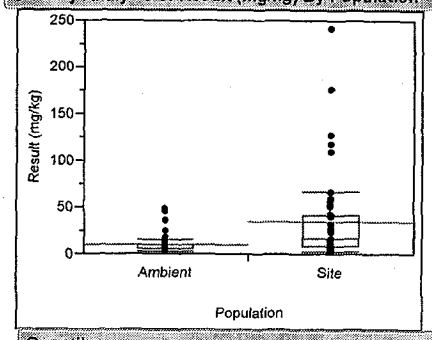


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	816	1600	1950	2400	3350	7520	66600
Site	1280	1460	2005	3070	4055	13980	110000

Site=3, Depth=0-8 ft bgs, Chemical=Copper

Oneway Analysis of Result (mg/kg) By Population

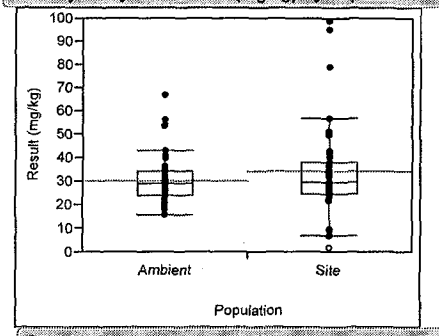


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	3.12	3.934	5.62	6.91	9.79	16.68	49.1
Site	3.4	5.1	9.35	18	42.4	110	243

Site=3, Depth=0-8 ft bgs, Chemical=Chromium

Oneway Analysis of Result (mg/kg) By Population

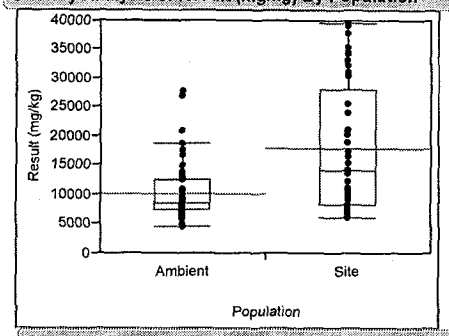


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	15.6	19.86	24.3	29.2	34	41.78	66.7
Site	1.9	22	25	29.9	38.2	51.4	99

Site=3, Depth=0-8 ft bgs, Chemical=Iron

Oneway Analysis of Result (mg/kg) By Population

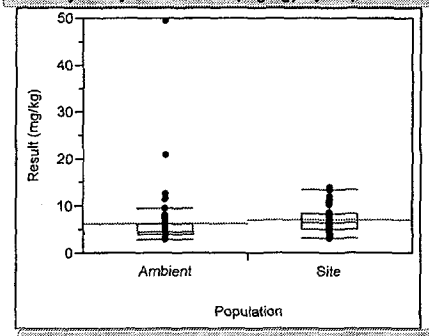


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	4500	6200	7520	8590	12500	17100	27900
Site	6210	7200	8295	14100	28050	34920	39700

Site=3, Depth=0-8 ft bgs, Chemical=Cobalt

Oneway Analysis of Result (mg/kg) By Population

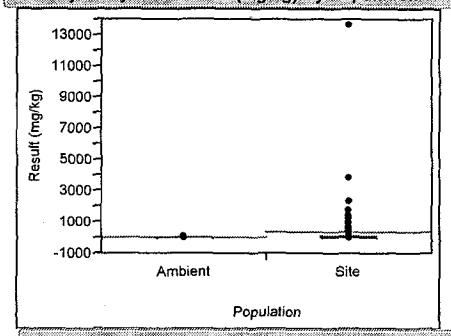


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	3.02	3.654	4.16	4.7	6.38	8.768	49.7
Site	3.2	3.84	5.05	6.4	8.6	11.14	14

Site=3, Depth=0-8 ft bgs, Chemical=Lead

Oneway Analysis of Result (mg/kg) By Population



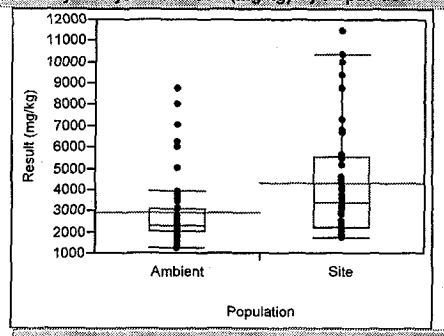
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.474	1.668	2.5	3.2	7.15	19.88	165
Site	0.17	2.8	5.9	20.6	61.8	705	13700

SOIL BOX PLOTS

Site=3, Depth=0-8 ft bgs, Chemical=Magnesium

Oneway Analysis of Result (mg/kg) By Population

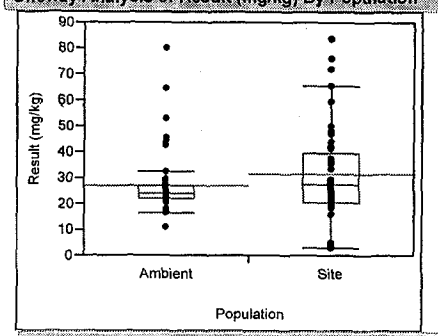


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1290	1812	2090	2320	3120	5476	8800
Site	1760	1912	2240	3400	5560	9044	11500

Site=3, Depth=0-8 ft bgs, Chemical=Nickel

Oneway Analysis of Result (mg/kg) By Population

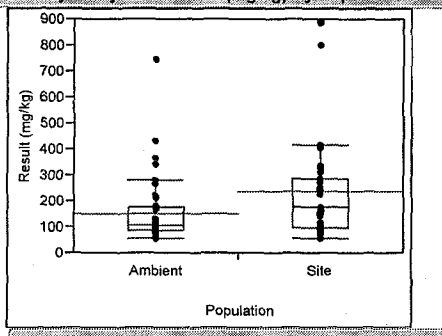


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	11.5	18.3	22.1	24.3	27.4	44.82	80.4
Site	3.5	16.2	20.95	27.8	40	60	84

Site=3, Depth=0-8 ft bgs, Chemical=Manganese

Oneway Analysis of Result (mg/kg) By Population

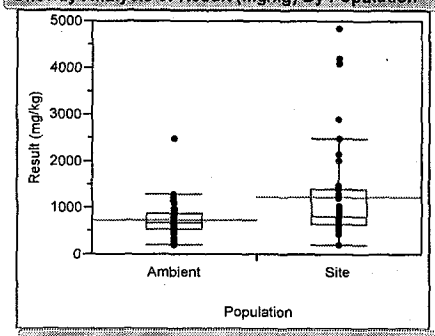


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	55.5	78.26	88.9	108	179	306	748
Site	57.7	75.62	100	180	285.5	411.6	891

Site=3, Depth=0-8 ft bgs, Chemical=Potassium

Oneway Analysis of Result (mg/kg) By Population

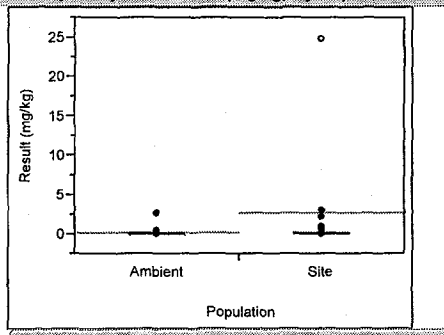


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	209	443.4	540	691	877	1108	2480
Site	213	526.6	646	823	1415	2904	4840

Site=3, Depth=0-8 ft bgs, Chemical=Mercury

Oneway Analysis of Result (mg/kg) By Population

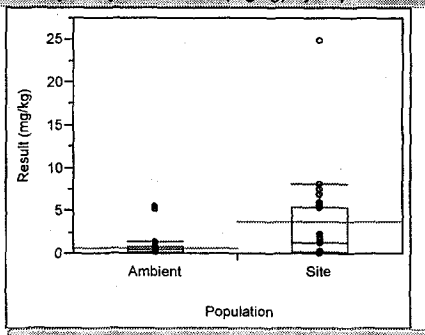


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.047	0.0505	0.0625	0.1035	0.1625	0.2115	2.71
Site	0.05	0.0619	0.1275	0.165	0.3175	22.81	25

Site=3, Depth=0-8 ft bgs, Chemical=Silver

Oneway Analysis of Result (mg/kg) By Population



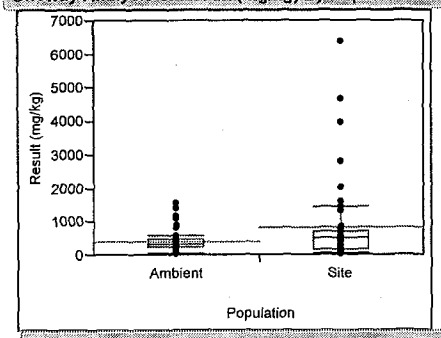
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.18	0.19	0.23	0.54	0.85	1.21	5.64
Site	0.058	0.19	0.23	1.3	5.45	8.2	25

SOIL BOX PLOTS

Site=3, Depth=0-8 ft bgs, Chemical=Sodium

Oneway Analysis of Result (mg/kg) By Population

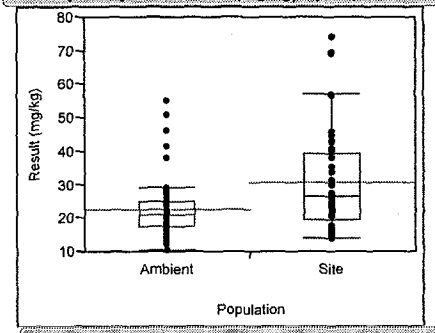


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	62.6	153.4	239	325	469	875.8	1580
Site	51.6	80.98	167	508	704	2342	6400

Site=3, Depth=0-8 ft bgs, Chemical=Vanadium

Oneway Analysis of Result (mg/kg) By Population

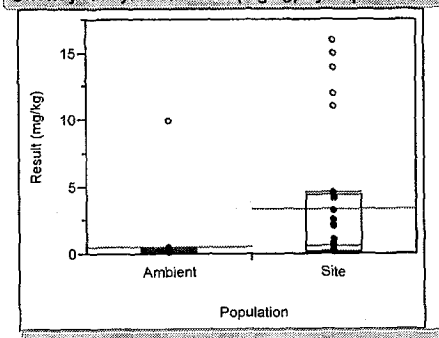


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	10.5	13.86	17.4	21	24.9	32.76	55.3
Site	14	15.66	19.4	26.6	39.2	57.16	74.5

Site=3, Depth=0-8 ft bgs, Chemical=Thallium

Oneway Analysis of Result (mg/kg) By Population

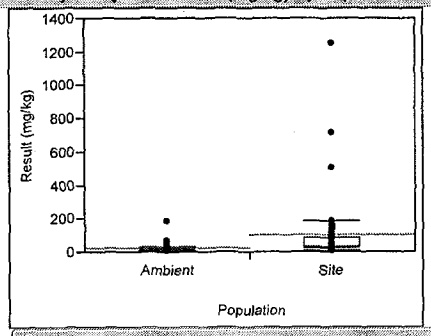


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.11	0.14	0.276	0.302	0.412	0.454	10
Site	0.11	0.116	0.225	0.61	4.45	12	16

Site=3, Depth=0-8 ft bgs, Chemical=Zinc

Oneway Analysis of Result (mg/kg) By Population

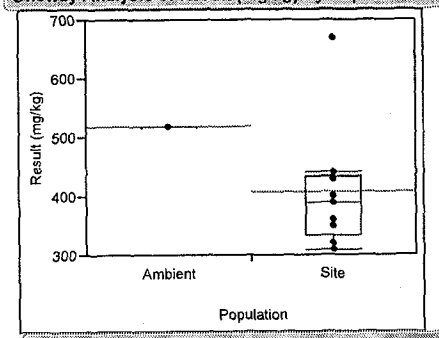


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	9.98	13.68	17.8	20.6	27.2	38.92	191
Site	15.3	18.4	23.65	35.3	90.65	168	1260

Site=3, Depth=0-8 ft bgs, Chemical=Titanium

Oneway Analysis of Result (mg/kg) By Population



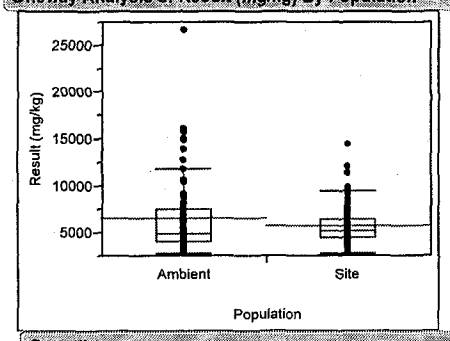
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	518	518	518	518	518	518	518
Site	310	310	335	390	435	670	670

SOIL BOX PLOTS

Site=4, Depth=0-8 ft bgs, Chemical=Aluminum

Oneway Analysis of Result (mg/kg) By Population

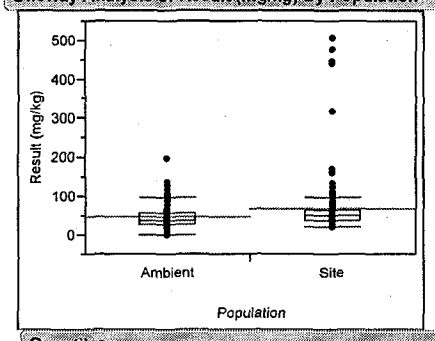


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	2880	3363	4122.5	4965	7520	14100	26800
Site	2670	3980	4510	5255	6520	7900	14470

Site=4, Depth=0-8 ft bgs, Chemical=Barium

Oneway Analysis of Result (mg/kg) By Population

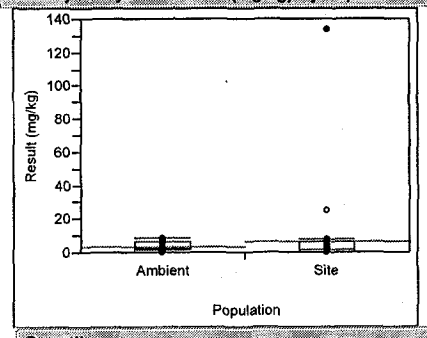


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.3	22.28	27.55	38.75	58.45	98.98	198
Site	23	27.4	37.625	52.2	64.675	101.95	507

Site=4, Depth=0-8 ft bgs, Chemical=Antimony

Oneway Analysis of Result (mg/kg) By Population

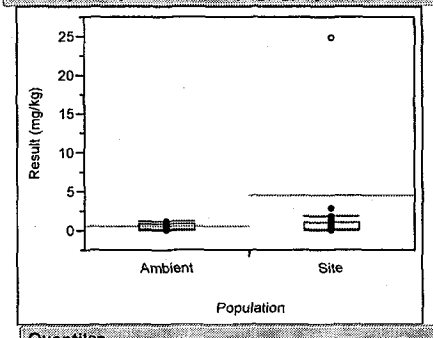


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.46	0.689	2.1	2.4	6.475	7.32	9.2
Site	0.4	0.46	0.5925	2.2	6.575	25	134

Site=4, Depth=0-8 ft bgs, Chemical=Beryllium

Oneway Analysis of Result (mg/kg) By Population

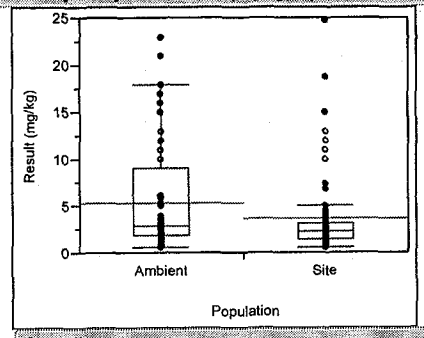


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.092	0.2	0.2	0.3	0.9425	1.2	1.3
Site	0.025	0.13	0.2	0.3	1.1	25	25

Site=4, Depth=0-8 ft bgs, Chemical=Arsenic

Oneway Analysis of Result (mg/kg) By Population

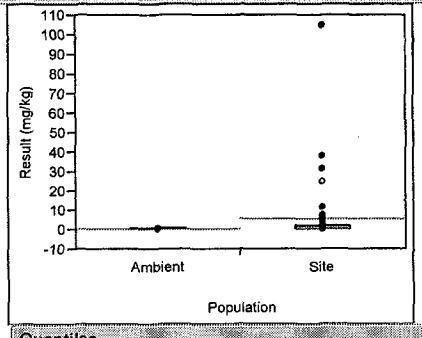


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.61	0.799	1.925	2.9	9.05	12.1	23
Site	0.65	1.2	1.5	2.3	3.1	11	24.8

Site=4, Depth=0-8 ft bgs, Chemical=Cadmium

Oneway Analysis of Result (mg/kg) By Population



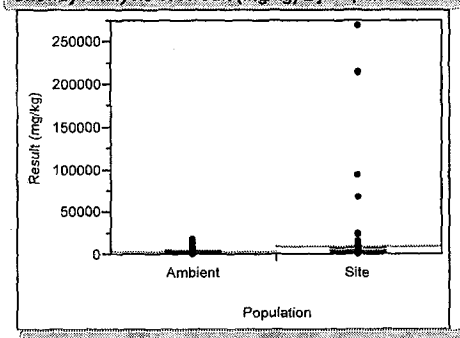
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.06	0.09	0.2	0.3	0.98925	1.2	1.3
Site	0.032	0.0756	0.1175	0.3595	1.61	25	105

SOIL BOX PLOTS

Site=4, Depth=0-8 ft bgs, Chemical=Calcium

Oneway Analysis of Result (mg/kg) By Population

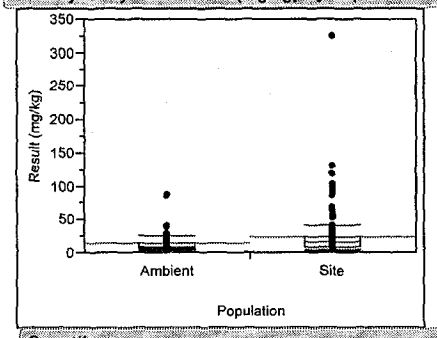


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1360	1676	2000	2600	3570	8701	19200
Site	980	2105	2547.5	3510	5127.5	10480	269000

Site=4, Depth=0-8 ft bgs, Chemical=Copper

Oneway Analysis of Result (mg/kg) By Population

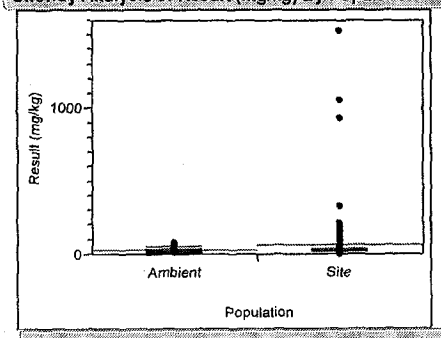


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	4.2	5.377	6.5	9.7	14.85	25.83	89.4
Site	4.3	6.54	9.625	16.6	25	54.69	326

Site=4, Depth=0-8 ft bgs, Chemical=Chromium

Oneway Analysis of Result (mg/kg) By Population

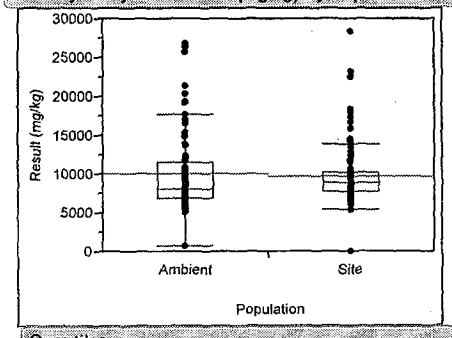


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	11.4	22.88	25.725	29.5	38.075	54.83	81.7
Site	4.6	24.78	25	31	40.6	94.55	1530

Site=4, Depth=0-8 ft bgs, Chemical=Iron

Oneway Analysis of Result (mg/kg) By Population

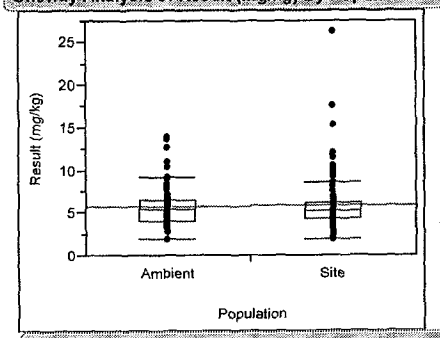


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	760	5689	6970	8140	11525	19310	26900
Site	103	7040	7772.5	8990	10300	13250	28500

Site=4, Depth=0-8 ft bgs, Chemical=Cobalt

Oneway Analysis of Result (mg/kg) By Population

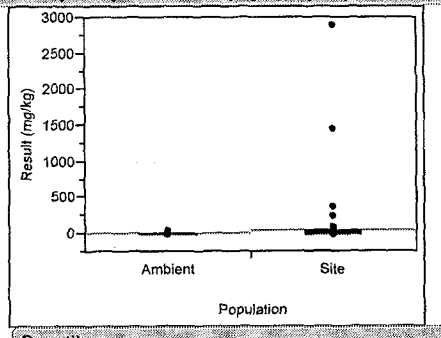


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1.9	3.4	4.1	5.35	6.475	9.1	14
Site	1.9	3.6	4.3	5.3	6.25	9.28	26.3

Site=4, Depth=0-8 ft bgs, Chemical=Lead

Oneway Analysis of Result (mg/kg) By Population



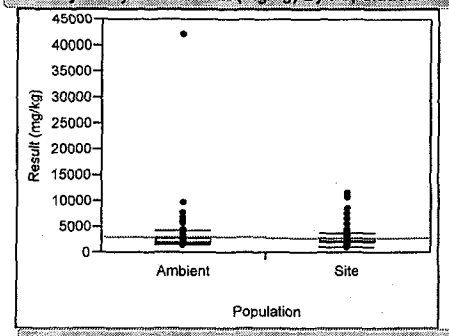
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1.3	1.69	4.575	5.9	6.45	9.82	41
Site	1.3	3	5.5	9.25	25	43.9	2900

SOIL BOX PLOTS

Site=4, Depth=0-8 ft bgs, Chemical=Magnesium

Oneway Analysis of Result (mg/kg) By Population

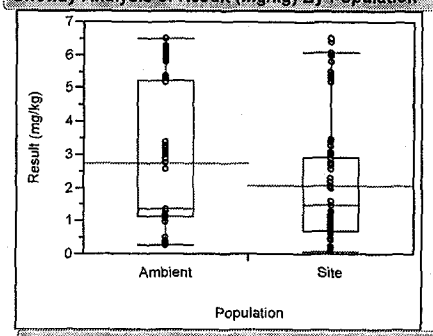


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1510	1700	1900	2240	3000	4383	42400
Site	1240	1810	2072.5	2375	2820	3880	11700

Site=4, Depth=0-8 ft bgs, Chemical=Molybdenum

Oneway Analysis of Result (mg/kg) By Population

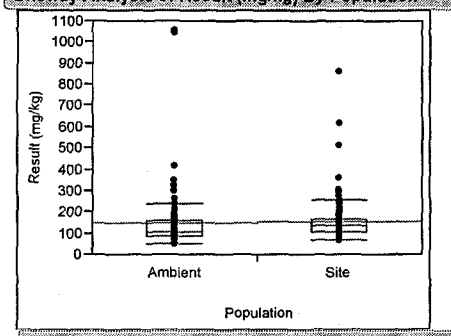


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.31	1	1.15	1.4	5.25	6.04	6.5
Site	0.11	0.458	0.715	1.5	2.95	5.44	6.5

Site=4, Depth=0-8 ft bgs, Chemical=Manganese

Oneway Analysis of Result (mg/kg) By Population

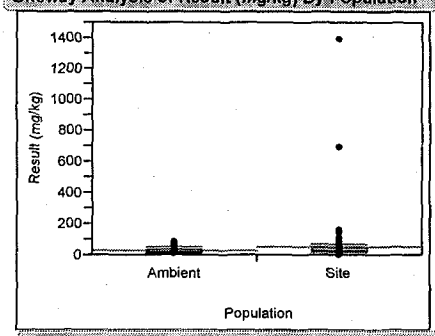


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	50	78.75	89.65	108.5	159.5	222.1	1060
Site	72	91.55	109	138	169.5	234.5	864

Site=4, Depth=0-8 ft bgs, Chemical=Nickel

Oneway Analysis of Result (mg/kg) By Population

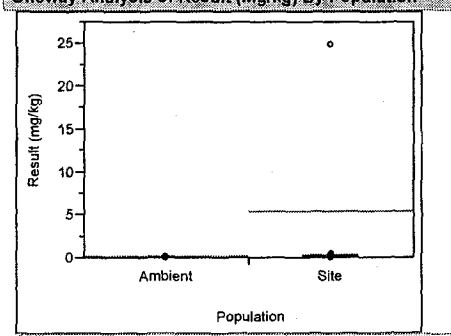


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	11.6	18.24	20.225	23.8	33.85	53.12	88.5
Site	7.8	20	23.3	28	42	62.64	1400

Site=4, Depth=0-8 ft bgs, Chemical=Mercury

Oneway Analysis of Result (mg/kg) By Population

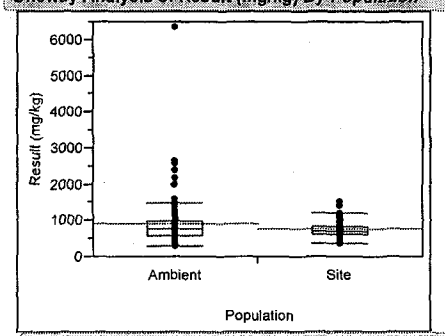


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.065	0.0713	0.1575	0.17	0.18	0.18	0.18
Site	0.05	0.06	0.097	0.16	0.23	25	25

Site=4, Depth=0-8 ft bgs, Chemical=Potassium

Oneway Analysis of Result (mg/kg) By Population



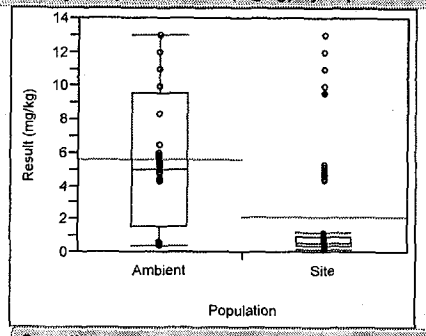
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	310	470	610	769.5	1000	1464	6382
Site	386	569.5	628.25	717	865.5	1109	1540

SOIL BOX PLOTS

Site=4, Depth=0-8 ft bgs, Chemical=Selenium

Oneway Analysis of Result (mg/kg) By Population

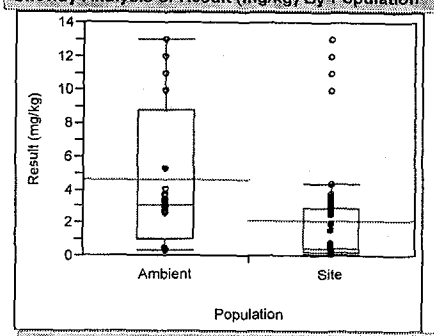


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.425	0.589	1.5925	5	9.6	12	13
Site	0.2	0.225	0.4325	0.595	0.995	9.8	13

Site=4, Depth=0-8 ft bgs, Chemical=Thallium

Oneway Analysis of Result (mg/kg) By Population

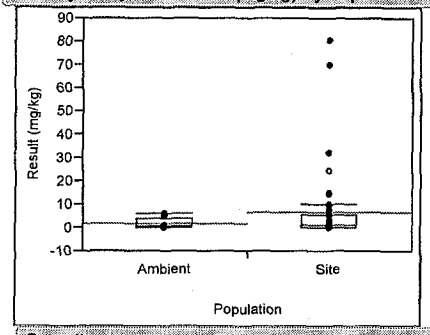


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.361	0.439	1.0475	3.1	8.825	12	13
Site	0.1	0.2824	0.302	0.47	2.9	10.8	13

Site=4, Depth=0-8 ft bgs, Chemical=Silver

Oneway Analysis of Result (mg/kg) By Population

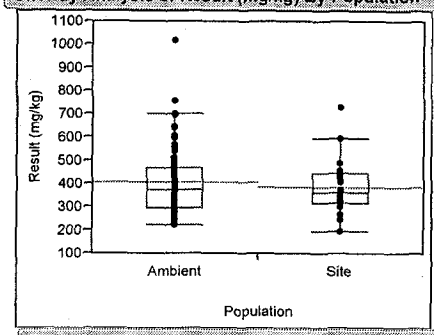


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.18	0.21	0.4325	0.7	4.195	6.01	6.5
Site	0.059	0.197	0.4325	1.2	6.075	25	81.1

Site=4, Depth=0-8 ft bgs, Chemical=Titanium

Oneway Analysis of Result (mg/kg) By Population

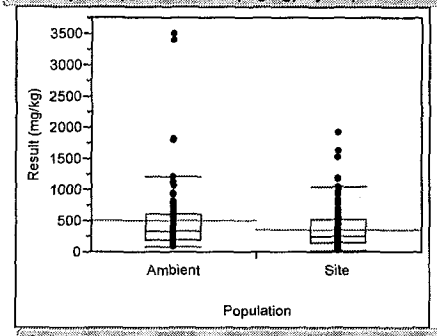


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	223	269.7	300	372.5	467.75	618.3	1020
Site	197	266	320	364	450	511.4	729

Site=4, Depth=0-8 ft bgs, Chemical=Sodium

Oneway Analysis of Result (mg/kg) By Population

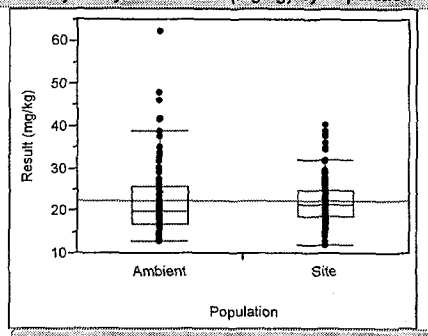


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	88.1	118.3	197	340	607.5	921	3510
Site	24.9	104	149	268.5	536.75	693	1930

Site=4, Depth=0-8 ft bgs, Chemical=Vanadium

Oneway Analysis of Result (mg/kg) By Population



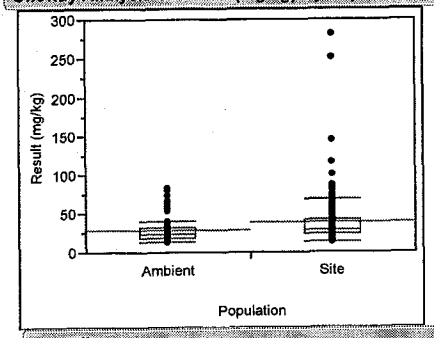
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	12.8	14	16.775	20	25.75	34.11	62.3
Site	12.1	16.8	18.825	21.35	24.8	29.25	40.4

SOIL BOX PLOTS

Site=4, Depth=0-8 ft bgs, Chemical=Zinc

Oneway Analysis of Result (mg/kg) By Population



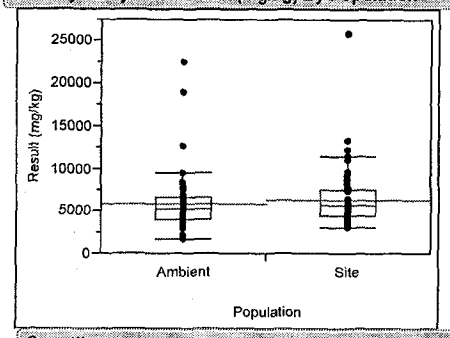
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	14	17.19	19	24.85	31.95	54.47	84
Site	13.6	19.03	23.775	29	42	68.56	263

SOIL BOX PLOTS

Site=11, Depth=0-8 ft bgs, Chemical=Aluminum

Oneway Analysis of Result (mg/kg) By Population

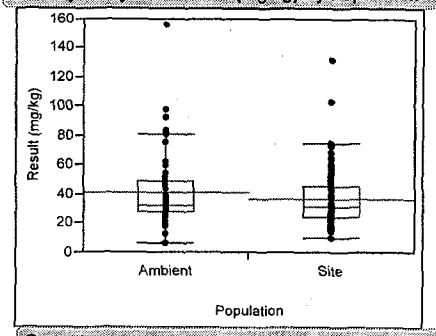


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1760	3244	4010	5230	6570	8282	22600
Site	3150	3826	4535	5665	7597.5	9226	25900

Site=11, Depth=0-8 ft bgs, Chemical=Barium

Oneway Analysis of Result (mg/kg) By Population

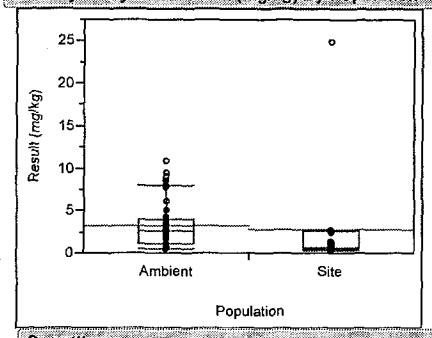


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	6.91	20.6	27.8	32.5	49.2	81.7	156
Site	10.3	18.46	24.3	31.3	46.1	64.24	132

Site=11, Depth=0-8 ft bgs, Chemical=Antimony

Oneway Analysis of Result (mg/kg) By Population

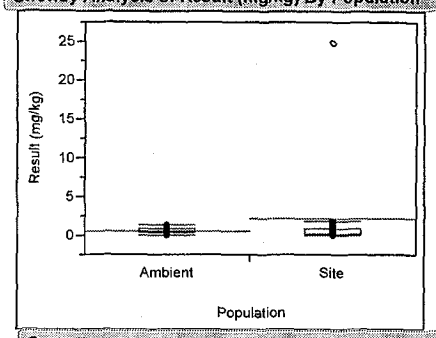


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.46	0.504	1.1	2.6	4	8.6	11
Site	0.4	0.427	0.4775	0.715	2.6	2.9	25

Site=11, Depth=0-8 ft bgs, Chemical=Beryllium

Oneway Analysis of Result (mg/kg) By Population

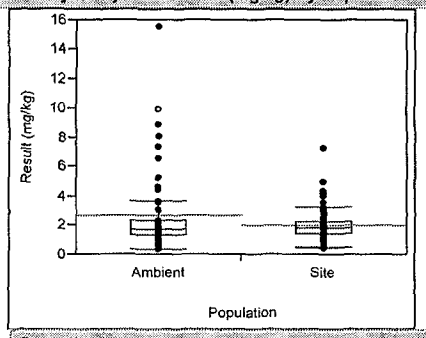


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.15	0.176	0.36	0.576	0.865	1.026	1.47
Site	0.042	0.0437	0.049	0.255	0.92975	1.59	25

Site=11, Depth=0-8 ft bgs, Chemical=Arsenic

Oneway Analysis of Result (mg/kg) By Population

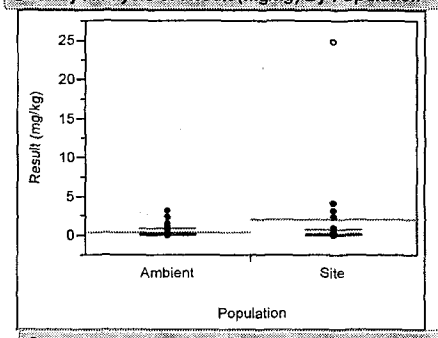


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.435	0.9188	1.4	1.7	2.34	6.956	15.6
Site	0.53	1.101	1.5	1.8	2.2375	3.2	7.37

Site=11, Depth=0-8 ft bgs, Chemical=Cadmium

Oneway Analysis of Result (mg/kg) By Population



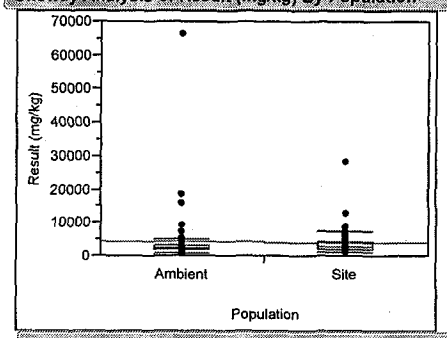
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.08	0.09	0.15	0.325	0.48	0.9922	3.19
Site	0.02	0.03	0.046	0.09	0.31225	3.228	25

SOIL BOX PLOTS

Site=11, Depth=0-8 ft bgs, Chemical=Calcium

Oneway Analysis of Result (mg/kg) By Population

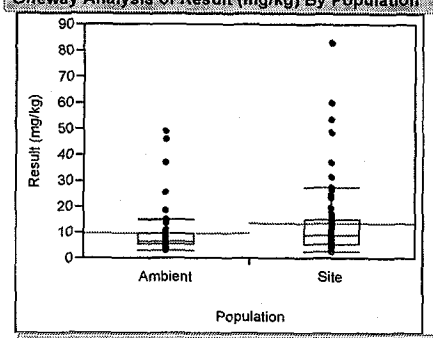


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	816	1600	1950	2400	3350	7520	66600
Site	1380	1810	2172.5	2915	4325	7000	28700

Site=11, Depth=0-8 ft bgs, Chemical=Copper

Oneway Analysis of Result (mg/kg) By Population

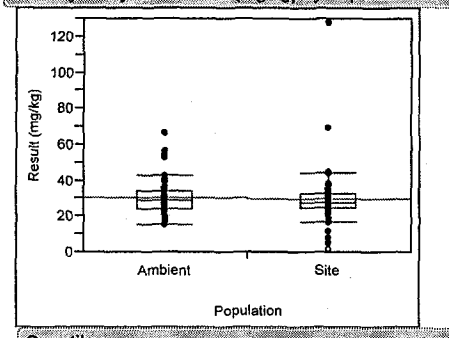


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	3.12	3.934	5.62	6.91	9.79	16.68	49.1
Site	3	4.97	5.9	9.265	15.15	27	83.2

Site=11, Depth=0-8 ft bgs, Chemical=Chromium

Oneway Analysis of Result (mg/kg) By Population

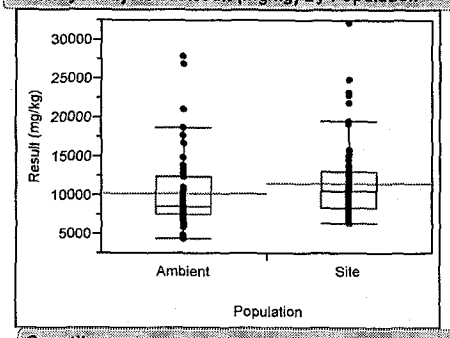


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	15.6	19.86	24.3	29.2	34	41.78	66.7
Site	1.7	22.61	25	27.9	32.975	38.1	128

Site=11, Depth=0-8 ft bgs, Chemical=Iron

Oneway Analysis of Result (mg/kg) By Population

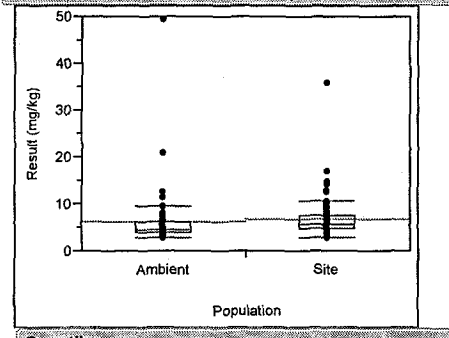


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	4500	6200	7520	8590	12500	17100	27900
Site	6430	7117	8475	10650	13125	15980	32200

Site=11, Depth=0-8 ft bgs, Chemical=Cobalt

Oneway Analysis of Result (mg/kg) By Population

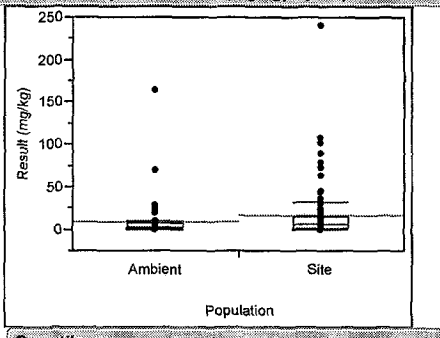


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	3.02	3.654	4.16	4.7	6.38	8.768	49.7
Site	2.8	3.913	4.905	5.8	7.75	10.15	36.1

Site=11, Depth=0-8 ft bgs, Chemical=Lead

Oneway Analysis of Result (mg/kg) By Population



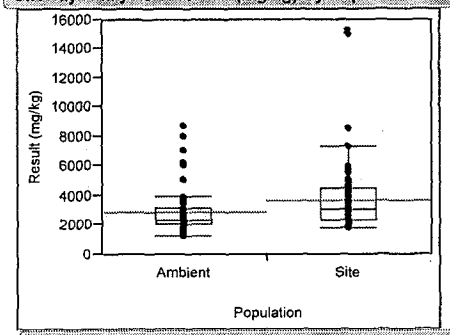
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.474	1.668	2.5	3.2	7.15	19.88	165
Site	0.34	1.6	2.3	7.03	15.95	35.8	242

SOIL BOX PLOTS

Site=11, Depth=0-8 ft bgs, Chemical=Magnesium

Oneway Analysis of Result (mg/kg) By Population

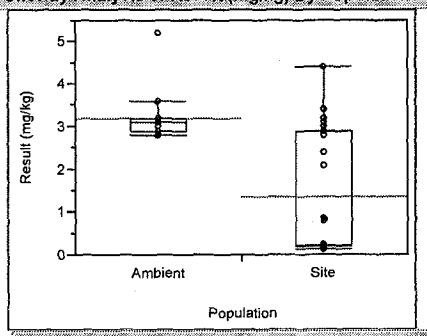


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1290	1812	2090	2320	3120	5476	8800
Site	1780	2021	2335	3090	4462.5	5692	15300

Site=11, Depth=0-8 ft bgs, Chemical=Molybdenum

Oneway Analysis of Result (mg/kg) By Population

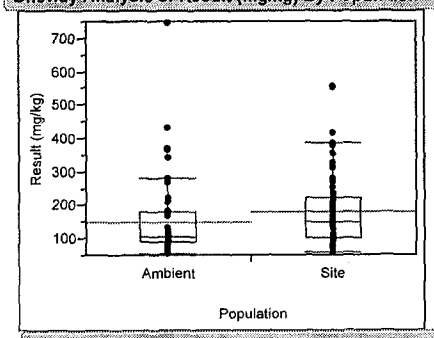


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	2.8	2.8	2.9	3.1	3.2	4.08	5.2
Site	0.14	0.178	0.21	0.24	2.9	3.1	4.4

Site=11, Depth=0-8 ft bgs, Chemical=Manganese

Oneway Analysis of Result (mg/kg) By Population

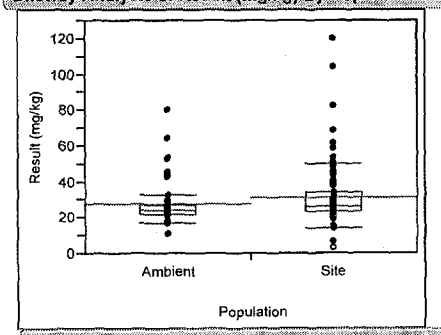


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	55.5	78.26	86.9	108	179	306	748
Site	60.6	79.23	102.25	150	222.25	326.1	558

Site=11, Depth=0-8 ft bgs, Chemical=Nickel

Oneway Analysis of Result (mg/kg) By Population

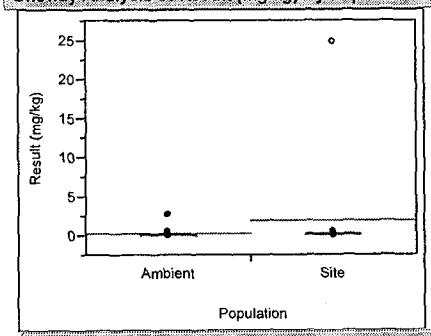


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	11.5	18.3	22.1	24.3	27.4	44.82	80.4
Site	3.3	20.34	23.25	26.4	34.175	50.5	120

Site=11, Depth=0-8 ft bgs, Chemical=Mercury

Oneway Analysis of Result (mg/kg) By Population

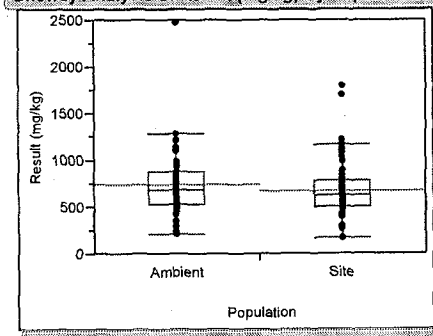


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.047	0.0505	0.0625	0.1035	0.1625	0.2115	2.71
Site	0.05	0.06	0.099	0.155	0.185	0.4954	25

Site=11, Depth=0-8 ft bgs, Chemical=Potassium

Oneway Analysis of Result (mg/kg) By Population



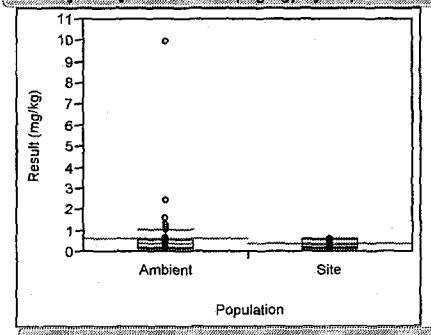
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	209	443.4	540	691	877	1108	2480
Site	176	419.6	511.25	628	778.5	1089	1800

SOIL BOX PLOTS

Site=11, Depth=0-8 ft bgs, Chemical=Selenium

Oneway Analysis of Result (mg/kg) By Population

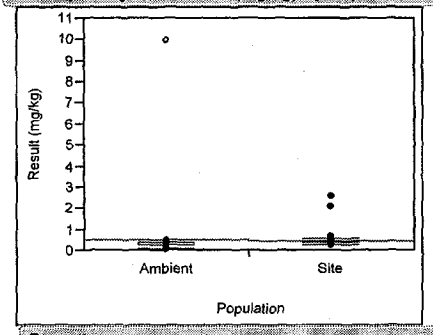


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.179	0.2076	0.22	0.424	0.59	1.128	10
Site	0.17	0.2003	0.22775	0.355	0.55	0.6	0.65

Site=11, Depth=0-8 ft bgs, Chemical=Thallium

Oneway Analysis of Result (mg/kg) By Population

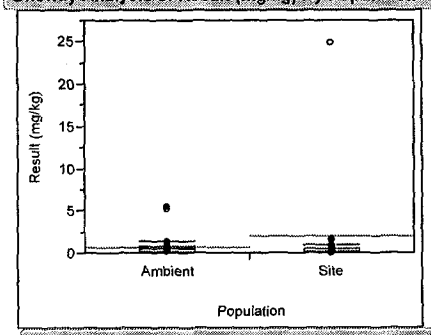


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.11	0.14	0.276	0.302	0.412	0.454	10
Site	0.247	0.2662	0.38	0.41	0.45	0.539	2.6

Site=11, Depth=0-8 ft bgs, Chemical=Silver

Oneway Analysis of Result (mg/kg) By Population

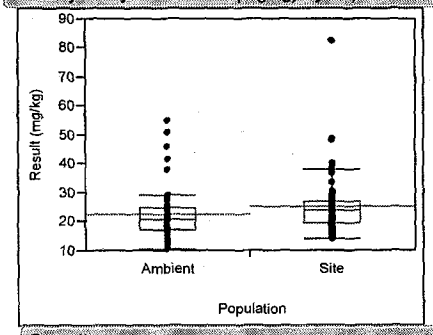


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.18	0.19	0.23	0.54	0.85	1.21	5.64
Site	0.084	0.0867	0.09875	0.19	0.56825	1.63	25

Site=11, Depth=0-8 ft bgs, Chemical=Vanadium

Oneway Analysis of Result (mg/kg) By Population

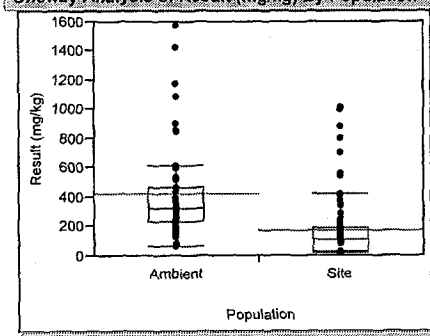


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	10.5	13.86	17.4	21	24.9	32.76	55.3
Site	14.1	15.66	19.35	23.95	27.25	37.42	82.5

Site=11, Depth=0-8 ft bgs, Chemical=Sodium

Oneway Analysis of Result (mg/kg) By Population

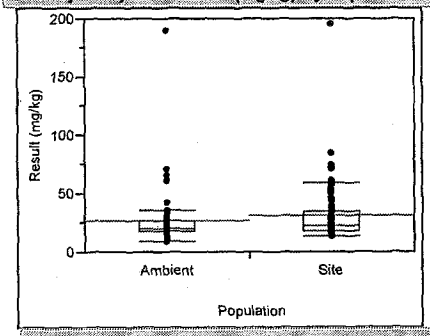


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	62.6	153.4	239	325	469	875.8	1580
Site	20	25	26.95	107.5	190.25	418.5	1020

Site=11, Depth=0-8 ft bgs, Chemical=Zinc

Oneway Analysis of Result (mg/kg) By Population



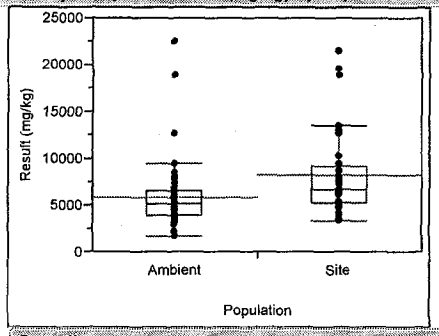
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	9.98	13.68	17.8	20.6	27.2	38.92	191
Site	14.4	16.54	17.875	23.2	34.875	58.14	196

SOIL BOX PLOTS

Site=21, Depth=0-8 ft bgs, Chemical=Aluminum

Oneway Analysis of Result (mg/kg) By Population

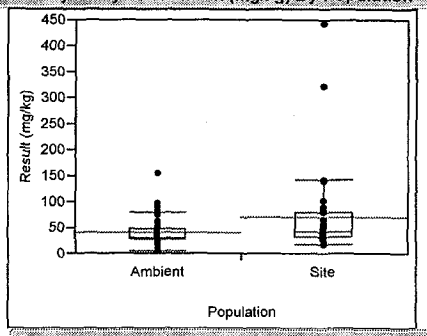


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1760	3244	4010	5230	6570	8282	22600
Site	3410	4172	5285	6710	9170	14680	21600

Site=21, Depth=0-8 ft bgs, Chemical=Barium

Oneway Analysis of Result (mg/kg) By Population

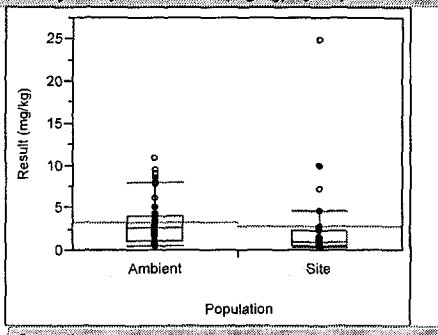


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	6.91	20.6	27.8	32.5	49.2	81.7	156
Site	18.1	28.06	34.8	42.7	82.3	141.6	443

Site=21, Depth=0-8 ft bgs, Chemical=Antimony

Oneway Analysis of Result (mg/kg) By Population

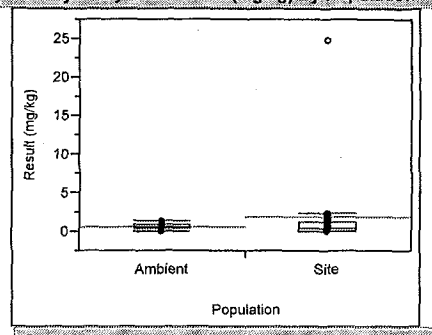


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.46	0.504	1.1	2.6	4	8.6	11
Site	0.4	0.43	0.48	0.96	2.4	7.3	25

Site=21, Depth=0-8 ft bgs, Chemical=Beryllium

Oneway Analysis of Result (mg/kg) By Population

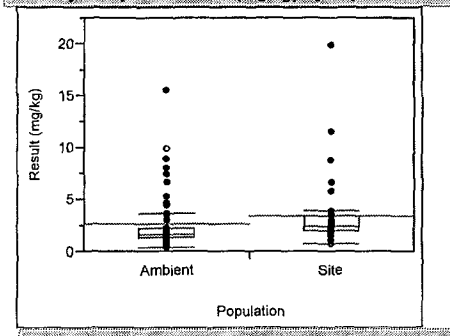


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.15	0.176	0.36	0.576	0.865	1.026	1.47
Site	0.024	0.027	0.14	0.49	1.3	2.1	25

Site=21, Depth=0-8 ft bgs, Chemical=Arsenic

Oneway Analysis of Result (mg/kg) By Population

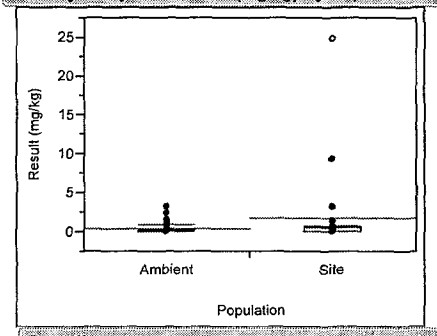


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.435	0.9188	1.4	1.7	2.34	6.956	15.6
Site	0.84	1.2	2.1	2.5	3.4	7.088	20

Site=21, Depth=0-8 ft bgs, Chemical=Cadmium

Oneway Analysis of Result (mg/kg) By Population



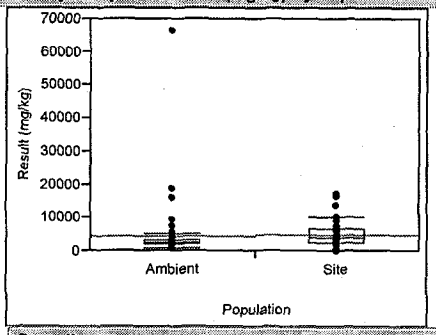
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.08	0.09	0.15	0.325	0.48	0.9922	3.19
Site	0.042	0.046	0.06	0.08	0.51	3.19	25

SOIL BOX PLOTS

Site=21, Depth=0-8 ft bgs, Chemical=Calcium

Oneway Analysis of Result (mg/kg) By Population

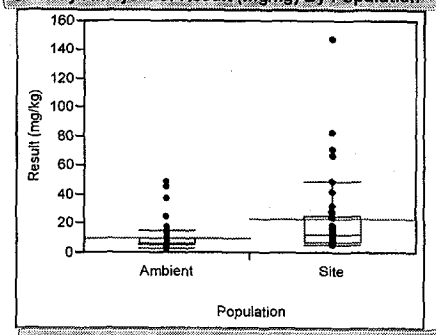


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	816	1600	1950	2400	3350	7520	66600
Site	341	1742	2420	3900	6640	11040	17300

Site=21, Depth=0-8 ft bgs, Chemical=Copper

Oneway Analysis of Result (mg/kg) By Population

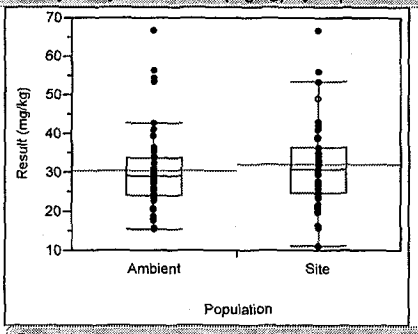


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	3.12	3.934	5.62	6.91	9.79	16.68	49.1
Site	5.4	6.3	7.8	12.7	25	67.2	148

Site=21, Depth=0-8 ft bgs, Chemical=Chromium

Oneway Analysis of Result (mg/kg) By Population

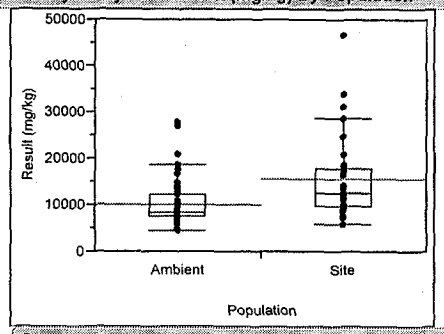


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	15.6	19.86	24.3	29.2	34	41.78	66.7
Site	11.3	20	24.8	31	36.4	49.2	67

Site=21, Depth=0-8 ft bgs, Chemical=Iron

Oneway Analysis of Result (mg/kg) By Population

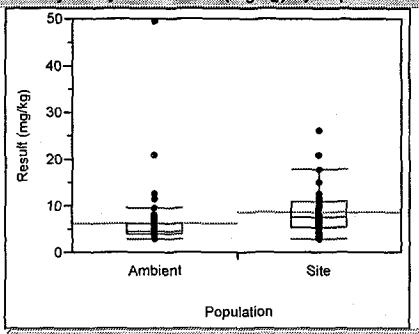


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	4500	6200	7520	8590	12500	17100	27900
Site	6080	7606	9850	12700	17900	29300	46800

Site=21, Depth=0-8 ft bgs, Chemical=Cobalt

Oneway Analysis of Result (mg/kg) By Population

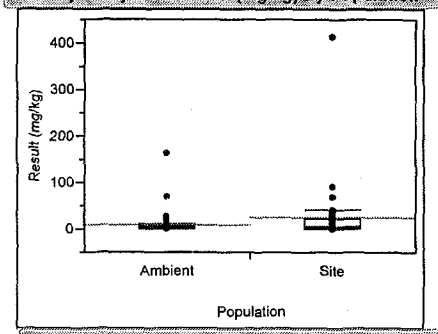


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	3.02	3.654	4.16	4.7	6.38	8.768	49.7
Site	2.9	3.98	5.5	7.6	11.1	15.72	26.2

Site=21, Depth=0-8 ft bgs, Chemical=Lead

Oneway Analysis of Result (mg/kg) By Population



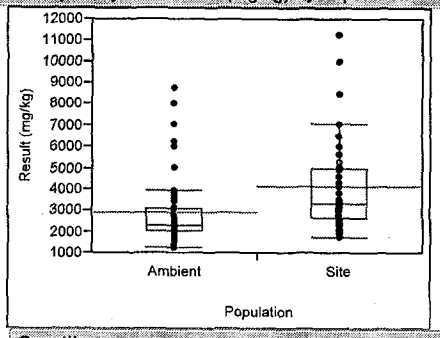
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.474	1.668	2.5	3.2	7.15	19.88	165
Site	1.4	2.1	3.4	8	25	44.1	416

SOIL BOX PLOTS

Site=21, Depth=0-8 ft bgs, Chemical=Magnesium

Oneway Analysis of Result (mg/kg) By Population

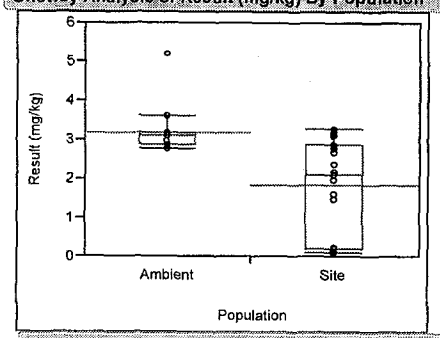


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	1290	1812	2090	2320	3120	5476	8800
Site	1760	2090	2700	3370	5015	7386	11300

Site=21, Depth=0-8 ft bgs, Chemical=Molybdenum

Oneway Analysis of Result (mg/kg) By Population

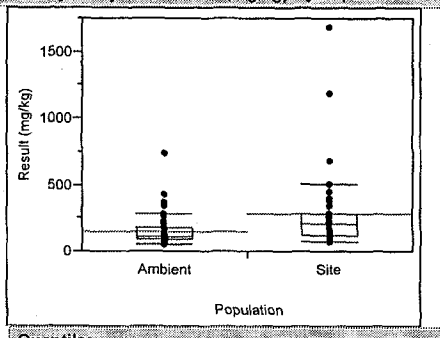


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	2.8	2.8	2.9	3.1	3.2	4.08	5.2
Site	0.11	0.112	0.23	2.1	2.9	3.18	3.3

Site=21, Depth=0-8 ft bgs, Chemical=Manganese

Oneway Analysis of Result (mg/kg) By Population

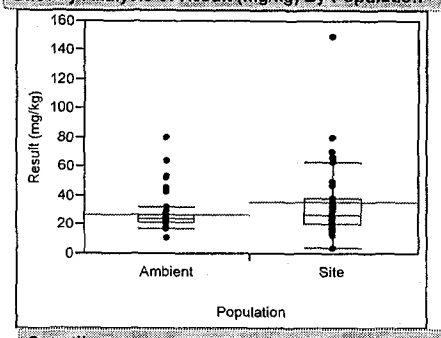


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	55.5	78.26	88.9	108	179	306	748
Site	71.8	90.6	122.5	206	285.5	544.6	1690

Site=21, Depth=0-8 ft bgs, Chemical=Nickel

Oneway Analysis of Result (mg/kg) By Population

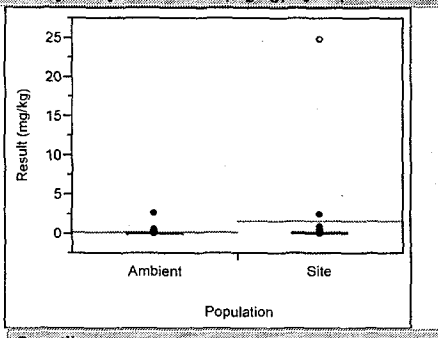


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	11.5	18.3	22.1	24.3	27.4	44.82	80.4
Site	4.3	17.7	20.9	27.4	38.3	67	150

Site=21, Depth=0-8 ft bgs, Chemical=Mercury

Oneway Analysis of Result (mg/kg) By Population

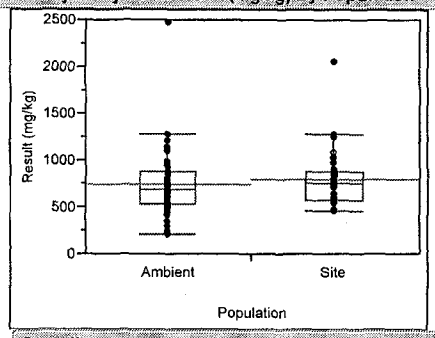


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.047	0.0505	0.0625	0.1035	0.1625	0.2115	2.71
Site	0.05	0.1	0.15	0.16	0.257	0.96	25

Site=21, Depth=0-8 ft bgs, Chemical=Potassium

Oneway Analysis of Result (mg/kg) By Population



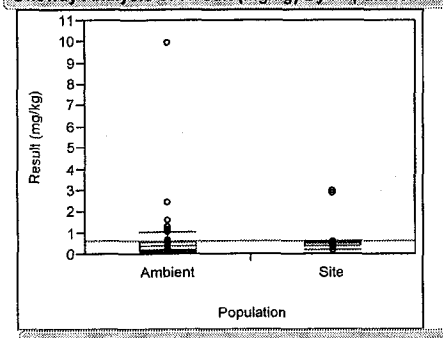
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	209	443.4	540	691	877	1108	2480
Site	461	486	582	760	885.5	1124	2060

SOIL BOX PLOTS

Site=21, Depth=0-8 ft bgs, Chemical=Selenium

Oneway Analysis of Result (mg/kg) By Population

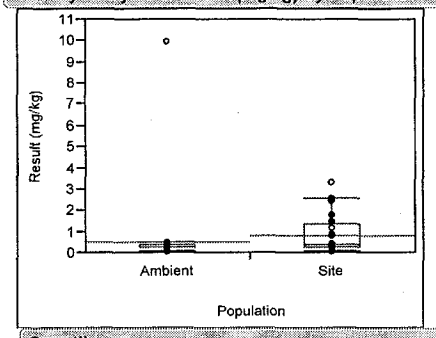


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.179	0.2076	0.22	0.424	0.59	1.128	10
Site	0.209	0.2188	0.425	0.54	0.6	0.63	3

Site=21, Depth=0-8 ft bgs, Chemical=Thallium

Oneway Analysis of Result (mg/kg) By Population

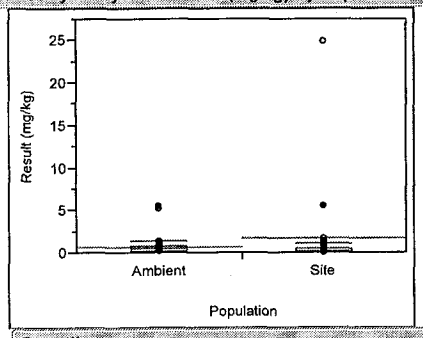


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.11	0.14	0.276	0.302	0.412	0.454	10
Site	0.1	0.2762	0.301	0.41	1.35	2.52	3.3

Site=21, Depth=0-8 ft bgs, Chemical=Silver

Oneway Analysis of Result (mg/kg) By Population

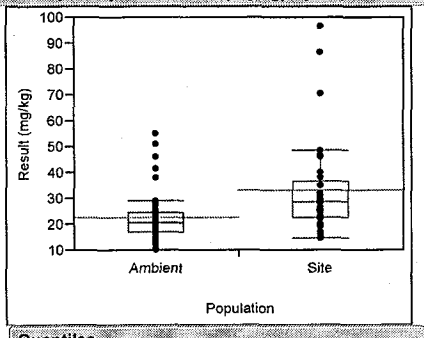


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	0.18	0.19	0.23	0.54	0.85	1.21	5.64
Site	0.056	0.063	0.18	0.21	0.607	1.7	25

Site=21, Depth=0-8 ft bgs, Chemical=Vanadium

Oneway Analysis of Result (mg/kg) By Population

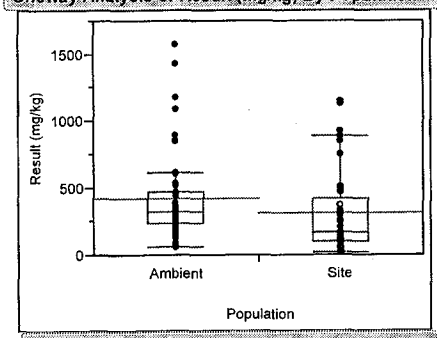


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	10.5	13.86	17.4	21	24.9	32.76	55.3
Site	14.6	16.98	22.8	28.9	36.8	53.12	96.6

Site=21, Depth=0-8 ft bgs, Chemical=Sodium

Oneway Analysis of Result (mg/kg) By Population

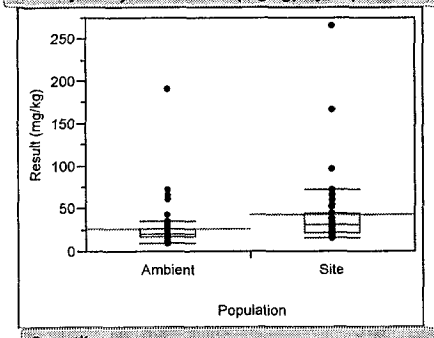


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	62.6	153.4	239	325	469	875.8	1580
Site	25.8	51.7	105	172	421.5	896.8	1150

Site=21, Depth=0-8 ft bgs, Chemical=Zinc

Oneway Analysis of Result (mg/kg) By Population



Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Ambient	9.98	13.68	17.8	20.6	27.2	38.92	191
Site	16.1	17.6	22.4	31.7	45	72.3	267

APPENDIX H

TOTAL PETROLEUM HYDROCARBON RISK EVALUATION FOR COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT SITES 3, 4, 11, AND 21

A-E CERCLA/RCRA/UST Contract Number N68711-03-D-5104
Contract Task Order 00102

Draft Final

Appendix H
TOTAL PETROLEUM HYDROCARBON RISK EVALUATION FOR COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT SITES 3, 4, 11, AND 21
Alameda Point, Alameda, California

May 16, 2005

Prepared for

DEPARTMENT OF THE NAVY
Glenna Clark, Remedial Project Manager
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared by

AND

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DS.B102.20059

TABLE OF CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAA	Corrective Action Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DTSC	California Environmental Protection Agency Department of Toxic Substances Control
EBS	Environmental baseline survey
EPA	U.S. Environmental Protection Agency Region 9
LUST	Leaking underground storage tank
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MTBE	Methyl tertiary butyl ether
NA	Not analyzed
NAS	Naval Air Station
Navy	U.S. Department of the Navy
ND	Not detected
OU	Operable Unit
PAH	Polynuclear aromatic hydrocarbons
Parsons	Parsons Engineering Science Inc.
PRC	Preliminary remediation criteria
RCRA	Resource Conservation and Recovery Act
RWQCB	San Francisco Bay Regional Water Quality Control Board
SWDIV	Naval Facilities Engineering Command, Southwest Division
TPH	Total petroleum hydrocarbons
TPH-associated compounds	BTEX, MTBE, and lead
TPH fractions	TPH-diesel range, -gasoline range, -jet fuel range, and -motor oil range

TTPH	Total total petroleum hydrocarbons
Tetra Tech	Tetra Tech EM Inc.
UST	Underground storage tank

H1.0 INTRODUCTION

This total petroleum hydrocarbon (TPH) risk evaluation was conducted in accordance with the preliminary remediation criteria (PRC) and closure strategy for petroleum-contaminated sites, referred to as the TPH strategy (U.S. Department of the Navy [Navy] 2001) at Alameda Point. The TPH strategy was developed using guidance prepared by the San Francisco Bay Regional Water Quality Control Board (RWQCB) for low-risk fuel site closure (RWQCB 1996). The TPH strategy addresses both soil and groundwater and was developed in agreement with the RWQCB, the U.S. Environmental Protection Agency Region 9 (EPA), and the California Environmental Protection Agency Department of Toxic Substance Control (DTSC). RWQCB issued a letter in June 2001 that states its concurrence with the PRC and TPH strategy presented in the Navy's memorandum (RWQCB 2001).

Soil and groundwater conditions at Sites 3, 4, 11, and 21 were evaluated during this TPH risk evaluation. Soil and groundwater data from Sites 3, 4, 11, and 21 were screened using the steps defined in the TPH strategy to determine whether corrective action is warranted. After each site was evaluated based on the TPH strategy, the results were assessed to determine whether all the RWQCB's criteria for low-risk fuel site closure were met. If corrective action is recommended for TPH concentrations present in soil and groundwater at Sites 3, 4, 11, and 21, then remedial alternatives will be evaluated in a corrective action plan.

Section 2.0 of this appendix summarizes the RWQCB's low-risk fuel site closure guidance, development of the PRC, and the TPH strategy screening steps. Sections 3.0 through 6.0 present the TPH risk evaluation for soils at each site and recommendations for corrective action (where applicable). Section 7.0 presents the TPH risk evaluation for groundwater beneath all four of the OU-2B sites (groundwater was evaluated beneath all four sites because of a common plume), and Section 8.0 provides the low-risk fuel site closure assessment and a summary of the risk evaluation for soil and groundwater at these sites. Section 9.0 presents a list of references used to prepare this appendix. Figures and tables follow Section 9.0.

H2.0 LOW-RISK FUEL SITE CLOSURE

The corrective action program for petroleum-impacted areas at Alameda Point is overseen by RWQCB in cooperation with EPA and DTSC. The Navy developed a plan for closing fuel sites at Alameda Point that complies with applicable laws and regulations and considers policies and guidelines established by RWQCB and EPA. Because of the nature and source(s) of contamination at Alameda Point, the Navy determined that the most appropriate approach to site closure is to follow guidance issued by RWQCB on the closure of low-risk fuel sites in the San Francisco Bay region (RWQCB 1996).

The RWQCB's guidance on low-risk fuel site closure was issued to address leaking underground storage tank (LUST) cleanups. While the majority of petroleum-impacted sites at Alameda Point were the result of fuel tank leaks, a few sites were identified based on petroleum contamination

from former fuel lines, aircraft maintenance and operation activities, road maintenance, and an oil refinery that preceded the Navy's operations. The RWQCB's low-risk fuel site closure guidance also is applied to these sites to ensure that any remaining concentrations of petroleum contamination pose a low risk and can be biodegraded passively. Otherwise, corrective action will be implemented until the remaining areas of petroleum contamination meet the RWQCB guidance criteria.

The RWQCB guidance for low-risk fuel site closure includes seven criteria that must be met to determine whether the site is a candidate for closure. These criteria include the following:

- The leak and source(s) have been removed.
- The site has been adequately characterized.
- Little or no groundwater impact currently exists, and no contaminants are found at concentrations above applicable water quality objectives.
- No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted.
- The site presents no significant risk to human health.
- The site presents no significant risk to the environment.
- The dissolved groundwater plume is not migrating.

To meet RWQCB criteria for low-risk fuel site closure, the soil and groundwater data at each site are evaluated based on the PRC and TPH strategy and then assessed for low-risk closure.

H2.1 PRELIMINARY REMEDIATION CRITERIA

Soil and groundwater PRC are screening concentrations that have been determined to be protective of human health or of marine ecological receptors. PRC are selected for each site based on proposed land reuse, groundwater designation, and potentially completed exposure pathways. The PRC are shown on Table H-2-1.

Derivation of the PRC for soil and groundwater, which also includes floating product screening criteria, is presented in the Navy memorandum (Navy 2001). The floating product screening criteria are used to determine whether further investigation is needed to assess possible floating product at a site. All sites are assessed for floating product regardless of the proposed land reuse and groundwater designation.

For soil, 14,000 milligrams per kilogram (mg/kg) was selected as the total total petroleum hydrocarbon (TTPH) screening level for floating product. The selection of 14,000 mg/kg of TTPH in soil to indicate floating product is considered to be conservative, based on industry-accepted saturation limits (Cohen and Mercer 1993). For groundwater, the water solubility limit (20 milligrams per liter [mg/L]) was chosen as the TTPH screening level for floating product. The selection of 20 mg/L as the groundwater solubility limit for TTPH was based on chemical data used in the San Francisco Airport study (RWQCB 1999), as presented in the fuel hydrocarbon transport modeling report (Parsons Engineering Source Inc. [Parsons] 2000).

H2.1.1 Soil Preliminary Remediation Criteria

Soil PRC were developed for TPH-associated compounds (benzene, toluene, ethylbenzene, xylenes [BTEX], methyl tertiary butyl ether [MTBE], and lead) and TPH fractions (TPH gasoline-, diesel-, jet fuel-, and motor oil-range). Two sets of PRC have been developed based on potential land reuse. PRC were developed for sites where residential or mixed-reuse (which includes residential reuse) is planned and for sites where no residential or mixed-reuse is planned. Soil PRC are based on data within 4 feet below ground surface (bgs). Soil samples deeper than 4 feet bgs are evaluated only for their potential to impact groundwater.

H2.1.2 Groundwater Preliminary Remediation Criteria

Groundwater PRC were developed for TPH-associated compounds and TTPH. TTPH is defined as the sum of all TPH fractions. Four sets of PRC were developed based on potential land reuse, groundwater designation, and potentially completed exposure pathways. PRC were developed for (1) volatilization of constituents from groundwater to indoor air, (2) groundwater designated as a potential drinking water source, (3) potential exposures to marine ecological receptors through the storm drain exposure pathway, and (4) potential exposures to marine ecological receptors through groundwater discharging to surface water. PRC for volatilization of constituents from groundwater to indoor air have been developed for sites where residential or mixed-reuse (which includes residential reuse) is planned and for sites where no residential or mixed-reuse is planned.

H2.2 TOTAL PETROLEUM HYDROCARBON STRATEGY

The TPH strategy is a series of steps that assesses the need for implementing soil and groundwater corrective actions, including comparing the data to the PRC. The soil and groundwater screening steps are summarized in the following sections.

H2.2.1 Soil Screening

Soil screening steps are summarized in the following text.

Step 1: Remove Surface Staining. If areas with significant surface staining are found during redevelopment or if surface staining is present in unpaved areas, then surface stains will be removed. Common surface stains from sources such as dripping oil pans or motor vehicle parking are not considered significant and will not be removed.

Step 2: Remove Floating Product. If TTPH concentrations in soil at any depth exceed the floating product screening level of 14,000 mg/kg (the saturation concentration), then a floating product investigation will be conducted unless deeper soil samples indicate that only surface contamination exists. If floating product is found, then active corrective action will be implemented in a timely manner.

Step 3: Identify CERCLA Contaminants of Concern. The purpose of this step is to identify whether the site has commingled contamination. If Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contaminants also are present at concentrations that may present a risk to human health or the environment, then TPH contamination commingled with CERCLA contaminants of concern may be addressed under the CERCLA program. The selected remediation technique should treat both types of contaminants and will depend on the concentrations of TPH and CERCLA contaminants. Otherwise, TPH remediation would occur after the remediation of CERCLA contaminants.

Step 4: Screen Data Against Site-Specific PRC. Soil PRC are selected for each site based on proposed land reuse. Concentrations of TPH-associated compounds and TPH fractions in soil from 0 to 4 feet bgs are screened against the PRC for residential and nonresidential reuse (see Table H-2-1). A screening interval of 0 to 4 feet bgs was chosen because the shallow depth to groundwater would limit soil contact at greater depths. Also, human and ecological receptors are most likely to experience direct contact with shallow soils rather than with deeper soils. Soil samples collected from deeper than 4 feet bgs are evaluated for potential impacts on groundwater.

Step 5: Conduct Additional Investigation. If sufficient data do not exist to characterize the site, then an additional investigation will be conducted.

Step 6: Determine Need for Corrective Action. Risk management considerations determine whether a corrective action is warranted. For example, if numerous samples were collected at a site, and the concentrations in only a few of those samples exceeded the PRC, and the PRC were not exceeded greatly by more than 1 sample, then corrective action may not be warranted. If risk management considerations favor corrective action, then remedial action alternatives will be evaluated in a corrective action plan.

H2.2.2 Groundwater Screening

Groundwater screening steps are summarized in the following text.

Step 1: Remove Floating Product. If TTPH concentrations in groundwater exceed the floating product screening level of 20 mg/L (the solubility limit), then a floating product investigation will be conducted. If floating product is found, active corrective action will be implemented in a timely manner.

Step 2: Identify CERCLA Contaminants of Concern. The purpose of this step is to identify whether the site has commingled contamination. If CERCLA contaminants also are present at concentrations that may present a risk to human health or the environment, then TPH contamination commingled with CERCLA contaminants of concern may be addressed under the CERCLA program. The selected remediation technique should treat both types of contaminants and will depend on the concentrations of TPH and CERCLA contaminants. Otherwise, TPH remediation would occur after the remediation of CERCLA contaminants.

Step 3: Conduct Storm Drain Investigation. Storm drains will be considered for a storm drain investigation if they are intersected by groundwater plumes at concentrations above PRC for potential exposure to marine ecological receptors through the storm drain exposure pathway (see Table H-2-1). If a storm drain investigation indicates that contaminated groundwater is infiltrating a storm drain, then remedial action alternatives will be evaluated. Remedial action alternatives will be evaluated for treating groundwater located near the storm drain reach and will not include storm drain repairs (unless used as a temporary measure to keep contaminated groundwater from infiltrating the storm drain system until the selected remedial action for groundwater is complete).

Step 4: Screen Data Against Site-Specific PRC. Groundwater PRC are selected for each site based on proposed land reuse, the groundwater designation, and potentially completed exposure pathways (see Tables H-2-1). The risk associated with each exposure scenario (ingestion, inhalation of vapors in indoor air, etc.) should be assessed; therefore, TTPH and TPH-associated compounds are screened against all applicable PRC (not only the most stringent PRC).

Step 5: Conduct Additional Investigation. If sufficient data do not exist to characterize the site, then an additional groundwater investigation will be conducted.

Step 6: Determine Need for Corrective Action. Risk management considerations determine whether a corrective action is warranted. For example, if numerous samples were collected at a site, and the concentrations in only a few of those samples exceeded the PRC, and the PRC was not exceeded greatly in more than 1 sample, then corrective action may not be warranted. If corrective action is warranted, then remedial action technologies will be evaluated in a corrective action plan.

H3.0 TOTAL PETROLEUM HYDROCARBON SOIL RISK EVALUATION FOR SITE 3

This section evaluates potential risks to human health and marine ecological receptors from TPH-associated compounds in soil at Site 3. Groundwater at Site 3 is evaluated in Section 7.0.

Summarized below are (1) the proposed land reuse and (2) the site-specific PRC, based on proposed land reuse and potentially completed exposure pathways:

- **Proposed Land Reuse.** Site 3 is designated as part of the Civic Core and Marina District land reuse areas (Alameda Redevelopment and Reuse Authority 1996). Land reuse may include recreational and commercial/industrial activities, with possible residential housing.

- **Soil PRC.** Residential PRC for TPH fractions and TPH-associated compounds were selected for Site 3 because potential reuse of the area includes residential housing.

Figure H-3-1 shows soil sampling locations for TPH and TPH-associated compounds at Site 3. Table H-3-1 summarizes analytical results for soil samples collected from Site 3. To evaluate the potential risk to human health and marine ecological receptors from TPH-associated compounds, analytical results were screened against the applicable site-specific PRC using the TPH strategy (Steps 1 through 6). Soil screening results are summarized below.

Step 1: Remove Surface Staining. Significant surface staining is not present at Site 3; therefore, a surface stain removal action is not warranted.

Step 2: Remove Floating Product. At location M03-04, the TTPH concentration in 1 soil sample exceeded the floating product screening level of 14,000 mg/kg in 1994 at a concentration of 19,700 mg/kg. This surface sample was collected from 2.5 to 3.5 feet bgs; however, the samples collected at 5 to 6 feet bgs and 10 to 11 feet bgs at this sampling location do not exceed the floating product screening level. In addition, the adjacent samples collected from 03GB017 from 2.5 to 3 and 4.5 to 5.5 feet bgs in 1994 did not exceed the floating product screening level. Therefore, a removal action is not warranted for floating product in soil at Site 3.

Step 3: Identify CERCLA Contaminants of Concern. CERCLA constituents identified in soil at Site 3 that could pose a risk to human health or the environment include arsenic, benzene, ethylbenzene, lead, and polynuclear aromatic hydrocarbons (PAH) (see Appendix F).

Step 4: Screen Data Against Site-Specific PRCs. TPH-fraction concentrations exceeded the PRC for residential reuse at 1 sampling location as TPH-gasoline range and at another sampling location as TPH-motor oil range (see Table H-3-1). TPH-associated compound concentrations exceeded PRC for residential reuse for benzene (0.65 mg/kg) at 3 sampling locations; lead exceeded PRC (221 mg/kg) at 6 sampling locations; xylenes exceeded PRC (210 mg/kg) at 1 sampling location (see Table H-3-1). Sampling locations and constituents are discussed in further detail in the following text.

TPH-Gasoline. TPH-gasoline range was detected above the residential PRC (1,030 mg/kg) at the western side of Site 3 at sampling location M03-04 in 1994 at a

concentration of 19,700 mg/kg. However, concentrations exceeding the PRC were not detected in subsequent samples collected at this location and other nearby locations.

TPH-Motor Oil. TPH-motor oil range was detected above the residential PRC (1,900 mg/kg) at the southeastern side of Site 3 at sampling location M03-07 in 1994 at a concentration of 43,700 mg/kg. However, concentrations exceeding the PRC were not detected at nearby locations sampled in 2001.

Benzene. Benzene was detected above the residential PRC (0.65 mg/kg) at the southwestern side of Site 3 at sampling location M03-07 in 1994 at a concentration of 7.5 mg/kg, and at sampling locations 127-SS-004 and 131-SS-001 in 1995 at concentrations of 0.75 and 12 mg/kg, respectively. However, concentrations exceeding the PRC were not detected at nearby locations.

Xylenes. Xylenes were detected above the residential PRC (210 mg/kg) at the western side of Site 3 at sampling location M03-04 in 1994 at a concentration of 250 mg/kg. However, concentrations exceeding the PRC were not detected in subsequent samples collected at this location and other nearby locations.

Lead. Concentrations of lead were detected above the residential PRC (221 mg/kg) at the southeastern side of Site 3 at sampling location M03-07 in 1994 at 2,380 mg/kg, at the northern side of Site 3 at sampling locations 116-Z21-004 and 118-Z21-002 in 1995, and at locations S03-DGS-DP10, S03-DGS-DP15, and S03-DGS-DP16 in 2001 at concentrations ranging from 229 to 613 mg/kg. However, concentrations exceeding the PRC were not detected in subsequent samples collected at nearby locations. Elevated lead concentrations (ranging from 533 to 13,700 mg/kg) were detected deeper than 4 feet bgs.

Step 5: Conduct Additional Investigation. Soil has been adequately characterized, and no data gaps were identified during this evaluation relating to the nature and extent of TPH contamination.

Step 6: Determine Need for Corrective Action. Corrective action is not warranted for soil at Site 3 because recent sampling results did not indicate detections exceeding the PRC. However, lead results deeper than 4 feet bgs should be evaluated under the CERCLA program.

H4.0 TOTAL PETROLEUM HYDROCARBON SOIL RISK EVALUATION FOR SITE 4

This section evaluates potential risks to human health and marine ecological receptors from TPH-associated compounds in soil at Site 4. Groundwater at Site 4 is evaluated in Section 7.0.

Summarized below are (1) the proposed land reuse and (2) the site-specific PRC, based on proposed land reuse and potentially completed exposure pathways.

- **Proposed Land Reuse.** Site 4 is a mixed-use zone designated as part of the Inner Harbor with the northern portion in the Civic Core land reuse area (Alameda Redevelopment and Reuse Authority 1996). While the Civic Core mixed-use zone may include residential structures, redevelopment would emphasize international business and commerce, research and development facilities, and support commercial uses (Naval Facilities Engineering Command, Engineering Field Activity West 1999). The Inner Harbor area is planned to be approximately 120 acres in the southeastern corner of Alameda Point. This reuse area is characterized as a combination of industrial, open space, and community support uses (Tetra Tech EM Inc. [Tetra Tech] 2000).

- **Soil PRC.** Residential PRC for TPH fractions and TPH-associated compounds were selected for Site 4 because potential reuse of the area includes residential housing.

Figure H-4-1 shows soil sampling locations for TPH and TPH-associated compounds at Site 4. Table H-4-1 summarizes analytical results for soil samples collected from Site 4. To evaluate the potential risk to human health and marine ecological receptors from TPH-associated compounds, analytical results were screened against the applicable site-specific PRC using the TPH strategy (Steps 1 through 6). Soil screening results are summarized below.

Step 1: Remove Surface Staining. Site 4 is approximately 65 percent open space consisting of paved vehicle parking, storage areas, and a large landscaped sports field along the eastern border. Significant surface staining is not present in unpaved areas within Site 4; therefore, a surface stain removal action is not warranted under the TPH program.

Step 2: Remove Floating Product. TTPH concentrations in soil do not exceed the floating product screening level of 14,000 mg/kg at any depth. One mobile laboratory TTPH result exceeded the floating product screening level in 1995 with a TTPH concentration of 28,480 mg/kg at sampling location 134-005-018 at a depth of 0 to 0.5 foot bgs. However, the TTPH concentration of the confirmation sample analyzed by a fixed laboratory was 2,600 mg/kg, which is below the floating product screening level (see Table H-4-1). One unconfirmed result from a surface location is not indicative of floating product contamination; therefore, a floating product removal action is not warranted.

Step 3: Identify CERCLA Contaminants of Concern. CERCLA constituents identified in soil at Site 4 that could pose a risk to human health or the environment include arsenic, cadmium, and PAHs (see Appendix F).

Step 4: Screen Data Against Site-Specific PRCs. TPH-fraction concentrations exceeded PRC for residential reuse at the following 12 sampling locations: TPH-gasoline range at sampling location 134-SS-001; TPH-jet fuel range at sampling location 030-S19-009; TPH-diesel range at

sampling location 030-MOD1-191; and TPH-motor oil at sampling locations 134-003-011, 134-003-013, 134-005-016, 134-005-017, 134-005-018, B04-31, B04-35, B04-43, and B04-44. (see Table H-4-1). In addition, TPH-associated compound concentrations exceeded the PRC for residential reuse for lead (221 mg/kg) at 4 sampling locations, including sampling locations 030-S19-009, 134-003-012, B04-41, and B360-9 (see Table H-4-1). Sampling locations and constituents are discussed in further detail in the following text.

TPH-Gasoline. A TPH-fraction concentration exceeded the residential PRC for the gasoline range (1,030 mg/kg) at 1 sampling location, 134-SS-001 (see Table H-4-1). The sample was collected in 1995 from 3.5 to 4 feet bgs and contained gasoline-range hydrocarbons at a concentration of 4,800 mg/kg. This sample is located north of Building 360, near a storm sewer catch basin.

TPH-Jet Fuel. A TPH-fraction concentration exceeded the residential PRC for the jet fuel range (1,380 mg/kg) at 1 sampling location, 030-S19-009 (see Table H-4-1). The sample was collected in 1998 from 0 to 4.5 feet bgs and contained jet fuel-range hydrocarbons at a concentration of 6,300 mg/kg. This sample is located outside the northwest corner of Building 372.

TPH-Diesel. A TPH-fraction concentration exceeded the residential PRC for the diesel range (1,380 mg/kg) at 1 sampling location, 030-MOD1-191 (see Table H-4-1). The sample was collected in 1998 from 0 to 5 feet bgs and contained diesel-range hydrocarbons at a concentration of 2,200 mg/kg. This sample is located west of Building 372, where two underground storage tanks (UST), UST 372-1 and UST 372-2, were removed in 1995.

TPH-Motor Oil. TPH-fraction concentrations exceeded the residential PRC for the motor oil range (1,900 mg/kg) at 9 sampling locations associated with Buildings 163A and 360.

In 1995, TPH-motor oil range concentrations exceeded the residential PRC in surface samples at five locations (134-003-011, 134-003-013, 134-005-016, 134-005-017, and 134-005-018) in or north of Building 163A. The surface samples initially were analyzed on site by a mobile laboratory, which reported detections of TPH-motor oil range concentrations in the range of 2,100 to 28,000 mg/kg. The sample with the highest concentration, 134-005-018, was sent to a fixed laboratory as a confirmation sample; the fixed laboratory reported a TPH-motor oil concentration of only 2,600 mg/kg.

TPH-motor oil range concentrations exceeded the residential PRC at four locations in Building 360. The samples collected in 1994 from sampling locations B04-31, B04-35, B04-43, and B04-44 contain TPH-motor oil range concentrations detected in the range of 1,990 to 3,610 mg/kg.

Lead. Lead concentrations exceeded the PRC for residential reuse in 5 soil samples.

Lead was detected in 1998 at soil sampling location 030-S19-009 from 0 to 4.5 feet bgs at a concentration of 367 mg/kg. This sample is located outside the northwest corner of Building 372.

Lead was detected in 1995 at soil sampling location 134-003-012 from 3 to 3.5 feet bgs at a concentration of 310 mg/kg. This sample is located in Building 163A, near the south end of the building. The lead concentration of the 0- to 0.5-foot bgs sample at this location was below the PRC for lead.

Lead was detected in 1994 at soil sampling location B04-41 from 0 to 1 foot bgs at a concentration of 371 mg/kg. This sample is located in Building 360, near the north end of the building. The lead concentrations of deeper samples (2.5 to 3.5 feet bgs and 4.5 to 5.5 feet bgs) at this location were below the PRC for lead.

Lead was detected in 1990 at soil sampling location B360-9 from 2.5 to 3 feet bgs at a concentration of 1,460 mg/kg. This sample is located east of Building 360, under Skyhawk Street. The lead concentration of a shallow sample (0.5 to 1 foot bgs) at this location is below the PRC for lead and lead is not detected in 4 deeper samples collected from 5.5 to 16 feet bgs at this location.

Step 5: Conduct Additional Investigation. Multiple soil samples were collected at Site 4 to assess possible TPH contamination (see Table H-4-1). Soil has been adequately characterized, and no data gaps were identified during this evaluation relating to the nature and extent of TPH contamination.

Step 6: Determine Need for Corrective Action. Corrective action is not warranted in soil at Site 4. TPH-fractions were detected in soil samples deeper than the screening criteria of 4 feet bgs on the west side of Building 372, indicating a potential impact to groundwater. However, significant soil contamination is not indicated by these detections that would warrant corrective action. Scattered surface soil detections in data collected in 1994 and 1995 (many only in mobile laboratory samples) in the motor oil range exceed only the residential PRC.

The lead concentrations above the PRC are in soil locations that do not correlate with the other TPH fractions. Lead also was evaluated under the CERCLA program's HHRA for Site 4 and was not identified as a chemical of potential concern for human health or the environment.

H5.0 TOTAL PETROLEUM HYDROCARBON SOIL RISK EVALUATION FOR SITE 11

This section evaluates potential risks to human health and marine ecological receptors from TPH-associated compounds in soil at Site 11. Groundwater at Site 11 is evaluated in Section 7.0.

Summarized below are (1) the proposed land reuse and (2) the site-specific PRC, based on proposed land reuse and potentially completed exposure pathways.

- **Proposed Land Reuse.** Site 11 is a mixed-use zone designated as part of the Marina District (Alameda Redevelopment and Reuse Authority 1996). This reuse area is characterized as a combination of residential and commercial or light industrial activities.
- **Soil PRC.** Residential PRC for TPH fractions and TPH-associated compounds were selected for Site 11 because potential reuse of the area includes residential housing.

Figure H-5-1 shows soil sampling locations for TPH and TPH-associated compounds at Site 11. Table H-5-1 summarizes analytical results for soil samples collected from Site 11. To evaluate the potential risk to human health and marine ecological receptors from TPH-associated compounds, analytical results were screened against the applicable site-specific PRC using the TPH strategy (Steps 1 through 6). Soil screening results are summarized below.

Step 1: Remove Surface Staining. Approximately 95 percent of Site 11 is covered with asphalt and concrete, and the site consists of buildings, roads, and parking lots. Therefore, a surface staining removal action is not warranted.

Step 2: Remove Floating Product. TTPH concentrations in soil do not exceed the floating product screening level of 14,000 mg/kg at any depth; therefore, a floating product removal action is not warranted (see Table H-5-1).

Step 3: Identify CERCLA Contaminants of Concern. CERCLA constituents identified in soil at Site 11 that could pose a risk to human health or the environment include copper and PAHs (see Appendix F).

Step 4: Screen Data Against Site-Specific PRCs. TPH-fraction concentrations exceeded PRC for residential reuse at the following 4 sampling locations: TPH-gasoline range at sampling location 030-S07-036 and TPH-jet fuel range at sampling locations 030-S07-033, 030-S07-036, and 030-S07-052 (see Table H-5-1). In addition, TPH-associated compound concentrations exceeded the PRC for residential reuse for lead (221 mg/kg) at 1 sampling location, M11-03 (see Table H-5-1). Sampling locations and constituents are discussed in further detail in the following text.

TPH-Gasoline. A TPH-fraction concentration exceeded the residential PRC for the gasoline range (1,030 mg/kg) at 1 sampling location 030-S07-036 (see Table H-5-1). The sample was collected in 1998 from 0 to 5 feet bgs and contained gasoline-range hydrocarbons at a concentration of 1,600 mg/kg. This sample is located south of Site 11 and west of USTs 37-17 through 37-19.

TPH-Motor Oil. A TPH-fraction concentration exceeded the residential PRC for the motor oil range (1,900 mg/kg) at 1 sampling location, B11-12 (see Table H-5-1). The sample was collected in 1994 from 0.5 to 1.5 feet bgs and contained motor oil-range hydrocarbons at a concentration of 3,260 mg/kg. This sample is located south of Building 14, near USTs 14-1 through 14-3.

TPH-Jet Fuel. TPH-fraction concentrations exceeded the residential PRC for the jet fuel range (1,380 mg/kg) at 3 sampling locations. Two of the locations are near USTs, and the remaining location is near a fuel line.

TPH-jet fuel range concentrations exceeded the residential PRC in two locations west of USTs 37-17, 37-18, and 37-19. The samples collected in 1998 from excavation confirmation sampling locations 030-S07-033 and 030-S07-036 contain TPH-jet fuel range concentrations at 1,670 and 2,200 mg/kg.

A TPH-jet fuel concentration exceeded the residential PRC at 030-S07-052 (see Table H-5-1). The excavation confirmation sample was collected in 1998 from 0 to 3 feet bgs and contained jet fuel range hydrocarbons at a concentration of 1,740 mg/kg. This sampling location is next to a fuel line south of Building 14.

Lead. Lead concentrations exceeded the PRC for residential reuse of 221mg/kg in 1 soil sample. Lead was detected in 1991 at soil sampling location M11-03 from 0.3 to 0.8 foot bgs at a concentration of 242 mg/kg. This sample is located outside the southwest corner of Building 14.

Step 5: Conduct Additional Investigation. Multiple soil samples were collected at Site 11 to assess possible TPH contamination (see Table H-5-1). Soil has been adequately characterized, and no data gaps were identified during this evaluation relating to the nature and extent of TPH contamination.

Step 6: Determine Need for Corrective Action. Corrective action is not warranted for soil at Site 11 under the TPH program. The floating product screening level was not exceeded, and only 4 soil sample results exceeded the PRC at locations and concentrations that do not indicate widespread TPH contamination of soil. Three excavation surface soil sample results exceeded the PRC for TPH-jet fuel range. One of those locations also exceeded the PRC for TPH-gasoline range, and 1 surface soil sample results exceeded the PRC for lead.

H6.0 TOTAL PETROLEUM HYDROCARBON SOIL RISK EVALUATION FOR SITE 21

This section evaluates potential risks to human health and marine ecological receptors from TPH-associated compounds in soil at Site 21. Groundwater at Site 21 is evaluated in Section 7.0.

Summarized below are (1) the proposed land reuse and (2) the site-specific PRC, based on the proposed land-reuse and the potentially completed exposure pathways.

- **Proposed Land Reuse and Groundwater Beneficial Use.** Site 21 is designated as part of the Marina District land reuse area (Alameda Redevelopment and Reuse Authority 1996). Land reuse may include residential homes mixed with offices, retail, service, and commercial establishments, or light industrial areas.

- **Soil PRC.** Residential PRC for TPH fractions and TPH-associated compounds were selected for Site 21 because potential reuse of the area includes residential housing.

Figure H-6-1 shows soil sampling locations for TPH and TPH-associated compounds at Site 21. Table H-6-1 summarizes analytical results for soil samples collected from Site 21. To evaluate the potential risk to human health and marine ecological receptors from TPH-associated compounds, analytical results were screened against the applicable site-specific PRC using the TPH strategy (Steps 1 through 6). Soil screening results are summarized below.

Step 1: Remove Surface Staining. Approximately 50 percent of Site 21 is covered with asphalt and concrete, and significant surface staining is not present at Site 21; therefore, a surface stain removal action is not warranted.

Step 2: Remove Floating Product. TTPH concentrations exceeded the floating product screening level of 14,000 mg/kg at the surface soil sampling location 126-001-001 in 1995. Two field-screening samples at this location detected concentrations of 19,300 and 28,900 mg/kg from 0 to 0.5 foot bgs (see Table H-6-1).

Step 3: Identify CERCLA Contaminants of Concern. CERCLA constituents identified in soil at Site 21 that could pose a risk to human health or the environment include arsenic, copper, and lead (see Appendix F).

Step 4: Screen Data Against Site-Specific PRCs. TPH-fraction concentrations exceeded PRC for residential reuse at 1 sampling location as TPH-diesel range, 2 sampling locations as TPH-gasoline range, and 2 sampling locations as TPH-motor oil range (see Table H-6-1). TPH-associated compound concentrations exceeded PRC for residential reuse as lead (221 mg/kg) at 2 sampling locations (see Table H-6-1). Sampling locations and constituents are discussed in further detail in the following text.

TPH-Diesel. TPH-diesel range was detected above the residential PRC (1,380 mg/kg) at the northwestern outer edge of Site 21 at only one sampling location 126-001-001 in 1995 at a concentration of 1,900 mg/kg in a field-screening sample.

TPH-Gasoline. TPH-gasoline range was detected above the residential PRC (1,300 mg/kg) at the northwestern outer edge of Site 21 at sampling location 125-001-003 in 1995 at concentrations of 1,700 and 2,000 mg/kg in field-screening samples, and at location 030-S07-072 in 1998 at a concentration of 1,300 mg/kg. However, these locations are not in close proximity to each other within Site 21. Also, concentrations exceeding the PRC were not detected in subsequent samples collected at nearby locations.

TPH-Motor Oil. TPH-motor oil range was detected above the residential PRC (1,900 mg/kg) at the northwestern outer edge of Site 21 at sampling location 126-001-001 in 1995 at concentrations of 18,000 and 27,000 mg/kg, and to the southwest of Site 21 at sampling location 030-S07-004 in 1998 at a concentration of 6,900 mg/kg in a field-screening sample.

Lead. Concentrations of lead were detected above the residential PRC (221 mg/kg) at the southeastern side of Site 21 at sampling location B07B-05 in 1994 at 416 mg/kg and at the northwestern side of Site 21 at sampling location 126-002-003 in 1995 at a concentration of 450 mg/kg.

Step 5: Conduct Additional Investigation. Soil has been adequately characterized, and no data gaps were identified during this evaluation relating to the nature and extent of TPH contamination.

Step 6: Determine Need for Corrective Action. Corrective action is not warranted for soil at Site 21 under the TPH program because concentrations exceeding the residential PRC were collected from unrelated sampling locations and did not indicate significant sources of soil contamination. In addition, concentrations exceeding the PRC were not detected in subsequent samples collected at nearby locations.

H7.0 TOTAL PETROLEUM HYDROCARBON GROUNDWATER RISK EVALUATION FOR OPERABLE UNIT 2B

This section evaluates potential risks to human health and marine ecological receptors from TPH-associated compounds in groundwater at Operable Unit (OU)-2B.

Summarized below are (1) the proposed land reuse and groundwater beneficial use and (2) the site-specific PRC, based on the proposed land-reuse, the groundwater designation, and the potentially completed exposure pathways.

- **Proposed Land Reuse and Groundwater Beneficial Use.** OU-2B is designated as parts of the Civic Core, Inner Harbor, and Marina District land reuse areas (Alameda Redevelopment and Reuse Authority 1996). Land reuse may include recreational and commercial/industrial activities, offices, retail, research and development, and residential housing. Groundwater at OU-2B is designated as part of the southeastern hydrologic region of Alameda Point and is considered a potential drinking water source (Tetra Tech 2000).

- **Groundwater PRC.** Residential PRC for volatilization of constituents to indoor air were selected for OU-2B because potential reuse of the area includes residential housing.

  Groundwater in the southeastern hydrologic region is considered a drinking water source; therefore, the PRC for potential drinking water sources were applied to OU-2B. Storm drains are located within OU-2B; therefore, PRC developed for potential exposures to marine ecological receptors through the storm drain exposure pathway were selected.

  The Seaplane Lagoon forms the closest shoreline to OU-2B and is located adjacent to and to the west of OU-2B. Therefore, PRC for potential exposures to marine ecological receptors through the groundwater discharging to surface water pathway were applied to the data from OU-2B sampling locations that are within 250 feet of the shoreline of the Seaplane Lagoon. The TPH Strategy excludes data from locations beyond a maximum distance of 250 feet from the shoreline for evaluations involving potential exposures to marine receptors through this pathway.

Figures H-7-1 through H-7-5 show groundwater sampling locations for TPH and TPH-associated compounds at OU-2B. Table H-7-1 summarizes analytical results for groundwater samples collected from OU-2B. To evaluate the potential risk to human health and marine ecological receptors from TPH-associated compounds, analytical results were screened against the applicable site-specific PRC using the TPH strategy (Steps 1 through 6). Groundwater screening results are summarized below.

Step 1: Remove Floating Product. TTPH concentrations exceeded the floating product screening level of 20 mg/L in 44 groundwater samples at 42 sampling locations (see Table H-7-1). Floating product was identified at the following locations:

- Sites 3 and 21 in the area east of Building 398 (known as Corrective Action Area [CAA] 3A and CAA 3B) at concentrations ranging from 27 to 2,029 mg/L

- Site 4 in the area west of and underneath Building 372 (known as CAA 4B) at concentrations ranging from 32.6 to 138,019 mg/L

- Associated with the fuel lines at Site 11 at concentrations ranging from 24.2 to 475 mg/L

- Associated with the fuel lines east of the Seaplane Lagoon at Site 21 at concentrations ranging from 36.56 to 120 mg/L

Therefore, a floating product removal action is warranted for OU-2B.

Step 2: Identify CERCLA Contaminants of Concern. Several halogenated volatile organic compounds, benzene, and metals were identified as chemicals of concern. Benzene is a CERCLA constituent (as well as a TPH constituent) identified in groundwater at OU-2B that could pose a risk to human health or the environment (see Appendix F).

Step 3: Conduct Storm Drain Investigation. TTPH exceeded the PRC of 1.4 mg/L for potential exposure to marine ecological receptors through the storm drain exposure pathway in 126 samples at 81 sampling locations (see Table H-7-1). However, only 66 of these locations were sampled within 50 feet of a nearby storm drain; therefore, only these locations were considered to exceed the PRC. TTPH was identified to exceed the PRC at the following locations:

- Sites 3 and 21 in the area east of Building 398 (known as CAA 3A, CAA 3B, and CAA 3C) at concentrations ranging from 3.67 to 2,029 mg/L

- Associated with Building 372 (known as CAA 4B) and Building 360 at Site 4 at concentrations ranging from 1.4 to 138,019 mg/L

- Associated with the fuel lines at Site 11 at concentrations ranging from 1.43 to 475 mg/L

- Associated with the fuel lines east of the Seaplane Lagoon at Site 21 at concentrations ranging from 1.5 to 120 mg/L

Benzene concentrations exceeded the PRC of 0.7 mg/L, ethylbenzene concentrations exceeded the PRC of 0.43 mg/L, and lead concentrations exceeded the PRC of 0.0081 mg/L for potential exposure to marine ecological receptors through the storm drain exposure pathway (see Table H-7-1). However, TPH-associated compound concentrations of toluene and MTBE did not exceed the PRC for potential exposure to marine ecological receptors through the storm drain exposure pathway at any of the sampling points (see Table H-7-1).

Benzene. Benzene concentrations exceeded the PRC of 0.7 mg/L for potential exposure to marine ecological receptors through the storm drain exposure pathway in 15 samples at 10 sampling locations. However, only four of these locations were sampled within 50 feet of a nearby storm drain; therefore, only these locations were considered to exceed the PRC. Three of

these locations are associated with Building 372 at Site 4, and one location is in Site 11, near a fuel line, with concentrations ranging from 0.7 to 2.768 mg/L.

Ethylbenzene. Ethylbenzene concentrations exceeded the PRC of 0.43 mg/L for potential exposure to marine ecological receptors through the storm drain exposure pathway in 9 samples at 7 sampling locations. However, only 4 of these locations were sampled within 50 feet of a nearby storm drain; therefore, only these locations were considered to exceed the PRC. Three of these locations are associated with Building 372 at Site 4, and 1 location is associated with Building 398 at Site 3, with concentrations ranging from 0.4805 to 3.364 mg/L.

Lead. Lead concentrations exceeded the PRC of 0.0081 mg/L for potential exposure to marine ecological receptors through the storm drain exposure pathway in 51 samples at 41 sampling locations. However, only 23 of these locations were sampled within 50 feet of a nearby storm drain; therefore, only these locations were considered to exceed the PRC. Eight of these locations are associated with the storm drain near Buildings 517 and 222 at the northern area of Site 3 with sample concentrations ranging from 0.0323 to 28.7 mg/L. Two of these locations are associated with CAA 3C in Site 3 with sample concentrations ranging from 0.103 to 1.31 mg/L. Eight of these locations are associated with the fuel lines at Site 11 with sample concentrations ranging from 0.0259 to 2.51 mg/L. Three of these locations are associated with Buildings 372 and 360 at Site 4 with sample concentrations ranging from 0.082 to 0.176 mg/L. Two locations are associated with the fuel lines east of the Seaplane Lagoon at Site 21 with sample concentrations of 0.0083 and 0.034 mg/L.

Many of the locations with concentrations exceeding PRC are near damaged sections of the storm drain (Tetra Tech 2001a). TPH-associated groundwater concentrations present a potential risk to ecological receptors through the storm drain exposure pathway. However, concentrations exceeding the PRC for potential exposure to marine ecological receptors through the storm drain exposure pathway were not detected in samples collected during one sampling event in 2001 at Outfall G and Outfall H, which are in the Seaplane Lagoon; therefore it appears the TPH contaminants may not be reaching the Seaplane Lagoon through the storm drain exposure pathway at Outfall G and Outfall H. However, corrective action is warranted for groundwater infiltrating the storm drains based on the samples that exceeded the PRC.

Step 4: Screen Data Against Site-Specific PRC. Concentrations of TTPH compounds and TPH-associated compounds were evaluated for groundwater discharge to surface water body criteria because OU-2B is located within 250 feet from the shoreline. However, some of the sampling locations are located greater than 250 feet from the shoreline; therefore, the sampling locations greater than 250 feet from the shoreline were not evaluated for groundwater discharge to surface water body criteria. TTPH compound concentrations at 10 sampling locations exceeded the PRC for marine ecological receptors for groundwater discharging to surface water. Lead concentrations exceeded the PRC for marine ecological receptors for groundwater discharging to surface water at 27 sampling locations. Groundwater concentrations of benzene, ethylbenzene, xylenes, or MTBE did not exceed the PRC for groundwater discharging to surface water.

TPH-associated compounds were evaluated for groundwater designated as a potential drinking water source and indoor air inhalation risk from volatilization of groundwater. BTEX, MTBE, and lead concentrations exceeded the PRC for groundwater designated as a potential drinking water source. Benzene concentrations also exceeded the PRC for volatilization of constituents from groundwater to indoor air. Sample results exceeding the PRC are discussed below.

TTPH. TTPH was detected at concentrations above the PRC for marine ecological receptors for groundwater discharging to surface water at 6 sampling locations within Site 21 and 4 sampling locations within Site 11 (see Table H-7-1). Sites 21 and 11 are located adjacent to the Seaplane Lagoon, and some of the sampling locations were within 250 feet of the shoreline. Site 11 sampling locations include CA11-21 (4.6 mg/L), CA11-22 (36 mg/L), CA11-23 (5 mg/L), and CA11-24 (32 mg/L) collected within 8 feet bgs. These samples are located along the former fuel line adjacent to the Seaplane Lagoon. Site 21 sampling locations include 030-IPC-330 (8.71 mg/L), CA11-20 (9.39 mg/L), S21-DGS-DP07 (120 mg/L), S21-DGS-VE01 (3.2 mg/L and 115.18 mg/L), S21-DGS-VE02 (12.31 mg/L), and S21-DGS-VE03 (36.56 mg/L) (see Figure H-7-5). These samples were collected along the former fuel lines adjacent to the Seaplane Lagoon and were collected within 9 feet bgs, with the exception of the sample collected from S21-DGS-DP11 at 20 feet bgs. A seawall is located along the eastern side of the Seaplane Lagoon; however, it is not confirmed whether migration to surface water has prevented the groundwater at all depths from migrating to the surface water to the west of the seawall. Therefore, there is the potential for TTPH in the groundwater to reach the marine ecological receptors.

Benzene. Benzene concentrations exceeded the PRC of 0.001 mg/L for a potential drinking water source at 77 sampling locations within OU-2B at concentrations ranging from 0.001 mg/L to 4.6 mg/L (see Table H-7-1). At Site 4, the majority of benzene concentrations above the drinking water PRC were located west of Building 372 (within CAA 4B) based on data collected during sampling events conducted in 1995 and 1997. At Site 11, the majority of benzene concentrations above the drinking water PRC were located along the former fuel lines within CAA 11 (also known as Area 37 under the Resource Conservation and Recovery Act [RCRA] program). Area 37 is undergoing corrective action for petroleum contamination under the Navy's petroleum cleanup program. At Site 3, the majority of the benzene concentrations exceeding the drinking water PRC were associated with the area northeast of Building 398 (CAA 3A) and the area west of Building 430 (CAA 3B). At Site 21, benzene concentrations that exceeded the drinking water PRC were detected at only a few unrelated locations, mostly within Building 162.

Benzene concentrations also exceeded the PRC of 0.00991 mg/L for volatilization from groundwater to indoor air at 37 sampling locations. The locations correspond to the same locations that exceed the PRC for drinking water as discussed above.

Toluene. Toluene concentrations exceeded the PRC of 0.15 mg/L for a potential drinking water source at 6 sampling locations. Sampling locations included M03-04 (highest concentration at 2.3 mg/L in 1995) and S03-DGS-DP-03 (0.17 mg/L) at Site 3; 372-2-ERM (0.157 mg/L),

372-4-ERM (0.2279 mg/L), and 372-5-ERM (0.7942 mg/L) at Site 4; and 030-FL1-508 (1.19 mg/L) at Site 11.

Ethylbenzene. Ethylbenzene concentrations exceeded the PRC of 0.3 mg/L for a potential drinking water source at 4 sampling locations. Sampling locations included S03-DGS-DP22 (2.4 mg/L in 2001) and 398-14-ERM (1.498 mg/L in 1995) at Site 3, and 372-5-ERM (3.364 mg/L in 1995) and 372-6-ERM (0.9386 mg/L in 1995) at Site 4.

Xylenes. Xylene concentrations exceeded the PRC of 1.75 mg/L for a potential drinking water source at 5 sampling locations. Sampling locations included 398-14-ERM (4.459 mg/L) in 1995; S03-DGS-DP22 (11.8 mg/L) in 2001 at Site 3; and 372-19-ERM (2.3 mg/L), 372-4-ERM (3.3 mg/L), and 372-5-ERM (18.7 mg/L) in 1995 at Site 4.

MTBE. MTBE concentrations exceeded the PRC of 0.005 mg/L for potential drinking water at 10 locations. Sampling locations included 030-MOD1-67 (0.035 mg/L), 372-10-MOJ (0.019 mg/L), 372-11-MOJ (0.0074 mg/L), 372-14-MOJ (0.046 mg/L), 37-MJ-MW7 (0.012 mg/L), 398-MW4 (0.043 mg/L), 030-IPC-330 (0.01 mg/L), 37MJ-MW1 (0.0062 mg/L), M11-04 (1.7 mg/L), and S04-5C-A (0.052 and 0.086 mg/L). These locations are predominantly located within Site 11 and near Building 372 at Site 4.

Lead. Lead was detected above the PRC for marine ecological receptors from groundwater discharging to surface water at 41 sampling locations within the boundaries of Sites 3, 4, 11, and 21 at concentrations ranging from 0.0098 mg/L to 105 mg/L (see Table H-7-1). The majority of the sampling locations are located along the former fuel lines at Site 11, near the former fuel storage tanks at Site 3 (also known as CAA 3C), and near Building 430 (also known as CAA 3B). While many of these locations are greater than 250 feet from the shoreline, lead does not biodegrade; however, lead often is attenuated in soil and therefore may not reach the shoreline. However, for the purpose of this screening evaluation, these locations greater than 250 feet with lead concentrations greater than 0.143 mg/L are considered to pose a potential risk to marine ecological receptors.

Lead was detected above the PRC of 0.015 mg/L for groundwater designated as a potential drinking water source at 39 sampling locations. The sampling locations were predominantly located within Site 11 in CAA 11 (Area 37) and at Site 3. Concentrations were detected up to 2.51 mg/L at Site 11 and 105 mg/L at Site 3.

Step 5: Conduct Additional Investigation. Multiple groundwater samples were collected at OU-2B to assess possible TPH contamination (see Table H-7-1). Groundwater has been adequately characterized, and no data gaps were identified during this investigation.

Step 6: Determine Need for Corrective Action. Corrective action is warranted for TTPH and TPH-associated compounds in groundwater at OU-2B. Groundwater data show TTPH, BTEX, MTBE, and lead concentrations are exceeding the PRC for risk to marine ecological receptors

from groundwater discharging to surface water, from the storm drain exposure pathway, from potential drinking water, and from inhalation of indoor air. Corrective action is currently being conducted under the Navy's TPH program to address groundwater contamination at Site 11 (known as CAA 11).

H8.0 LOW-RISK FUEL SITE CLOSURE ASSESSMENT SUMMARY

Table H-8-1 summarizes results of the low-risk fuel site closure assessment for OU-2B. The assessment indicates that the RWQCB criteria for low-risk fuel site closure have not been met for OU-2B.

H9.0 REFERENCES

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